



# Online Public Dialogue on Genome Editing in Farmed Animals

Research by Basis Social on behalf of the Nuffield Council on Bioethics

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\*Denotes a member of the Nuffield Council on Bioethics Working Group on Genome editing in Farmed Animals. With special thanks to Lynn Frewer who played an advisory role on the dialogue.

# Foreword



**Danielle Hamm**

Director, Nuffield Council on Bioethics

Genome editing is the precise, targeted alteration of a sequence of DNA in a living cell. Recent advances in genome editing techniques have had a transformative impact on biological research, leading to a number of potential applications across many sectors. In a previous Nuffield Council on Bioethics report, *Genome editing: an ethical review*, we identified emerging applications of genome editing in farmed animals (livestock and fish) as an area that was relatively well advanced, that raised distinctive ethical issues, and yet had been little discussed in public.

The findings of this dialogue will inform our in-depth inquiry into the implications of genome editing technologies in farmed animals. As part of this work, we wanted to explore how non-specialist members of the public viewed these emerging technologies – what they felt were the wider social and ethical issues raised and what considerations should guide the implementation and governance of these new technologies. This dialogue shows us there are good reasons to think about how to regulate new breeding technologies in a way that brings them into line with a broader vision for the future of food and farming systems.

This public dialogue is much more than a source of evidence to inform our own inquiry – although we will reflect carefully on the findings. It stands, in its own right, as a contribution to the growing public debate on genome editing (one of the first to focus specifically on genome editing and farmed animals). This is all the more timely as, earlier this year, the UK Department for the Environment, Food and Rural Affairs (Defra) held a written consultation on the regulation of genetic technologies, with a focus on genome editing in agriculture.

A key finding of the dialogue is that members of the public have a strong interest and desire to influence the way in which the food they consume is grown and reared. As the UK considers future regulatory approaches to biotechnologies it is important that the public are further engaged and not drowned out by those with longstanding interests in the debate. We believe that this public dialogue should be viewed as the starting point for further engagement: one initiative of this kind can only speak for the richness and diversity of public views that we have begun to uncover.

Deliberative processes, like this public dialogue, show how such a debate can develop reflectively, taking account of people's different interests and perspectives, and the challenges that face them collectively. Many of us will remember debates around the first generation of genetic modification (GM) technologies and how those on different sides of the debate ended up talking past each other. We are now contemplating a new generation of more sophisticated genome technologies, that open new possibilities in a context of new and urgent challenges to the food and farming system. These challenges have implications for all parts of society, nationally and globally. The quality of this debate will determine the future of this generation of biotechnologies, but also the direction for our future food systems, our farming industry, our national landscapes, and the wider environment.

# Executive summary

## Introduction and background

Genome editing (or gene editing)<sup>1</sup> refers to a group of technologies that enable the deliberate alteration of a targeted DNA sequence in a living cell, providing the ability to insert, delete, modify, or replace the DNA of an organism.<sup>2</sup> The application of genome editing in farmed animals is one of the most near-term, but least discussed, uses of the technology. Potential applications include improving the disease resistance of animals to increasing their productivity.<sup>3</sup> However, their use raises questions about potentially negative impacts on animal welfare and farming practices.<sup>4</sup>

The Nuffield Council on Bioethics (NCoB) is an independent body that informs policy and public debate about the ethical questions raised by biological and medical research. NCoB is currently running an inquiry into the ethical and social issues raised by genome editing in farmed animals.<sup>5</sup> As part of this work, NCoB commissioned Basis Social, in partnership with Bright Harbour Research, to undertake a rapid online public dialogue on genome editing in farmed animals, including fish.<sup>6</sup>

Following the passage of the Agriculture Bill in 2020, the Department for Environment, Food and Rural Affairs (Defra) launched a consultation on the regulation of genetic technologies in agriculture and aquaculture in January 2021.<sup>7</sup> This consultation sought views on whether genome edited organisms should be regulated as genetically modified organisms (GMOs), foregrounding the question of product safety in relation to farmed animals. The Food Standards Agency (FSA) has also recently published research on consumer perceptions of genome edited food,<sup>8</sup> primarily focused on understanding consumer awareness, acceptability, and labelling requirements – and again, concerned with safety considerations. While safety is important, by focusing the debate on a narrow set of technical concerns the risk is that wider considerations around the use and governance of such technologies is overlooked.

In this context, NCoB commissioned this dialogue to create a space for members of the public to help frame the issues around genome editing in their own terms and to enable reflection on the attendant ethical issues surrounding its application in farmed animals. On three weekday evenings between 15<sup>th</sup> June and 15<sup>th</sup> July 2021, 41 members of the public were convened to take part in a dialogue to identify key issues and perspectives around its potential use. Participants engaged with a range of expert stakeholders, stimulus material, and exercises designed to help them deliberate on the issues. As well as NCoB's own inquiry, it is hoped that the dialogue will contribute to future policy development and public debate on this issue.

<sup>1</sup> These terms were used interchangeably throughout the dialogue. We have used the term 'genome editing' in this report, except where the 'gene editing' was directly used by participants or in stimulus.

<sup>2</sup> Nuffield Council on Bioethics (2018) Genome editing and human reproduction: social and ethical issues

<sup>3</sup> Tait-Burkard, C., Doeschl-Wilson, A., McGrew, M.J. *et al* (2018) Livestock 2.0 – genome editing for fitter, healthier, and more productive farmed animals. *Genome Biology* volume 19, Article number: 204.

<sup>4</sup> de Graeff, N., Jongsma, K., Johnston, J., Hartley, S. and Bredenoord, A. (2019). The ethics of genome editing in non-human animals: a systematic review of reasons reported in the academic literature. *Phil. Trans. R. Soc. B* 374. Available at: <https://royalsocietypublishing.org/doi/pdf/10.1098/rstb.2018.0106>

<sup>5</sup> <https://www.nuffieldbioethics.org/publications/genome-editing-and-farmed-animals>

<sup>6</sup> Public dialogue is a process of deliberative group discussion which recognises the value that members of the public add to decision-making around policy, legislation and regulation, particularly around complex issues, or controversial topics. It is a form of democratic engagement involving a range of citizens, who are provided with the space, time, and information through which to meaningfully discuss the issues under consideration.

<sup>7</sup> <https://consult.defra.gov.uk/agri-food-chain-directorate/the-regulation-of-genetic-technologies/>

<sup>8</sup> <https://www.food.gov.uk/research/research-projects/consumer-perceptions-of-genome-edited-food>

## Summary

- Participants framed genome editing in farmed animals through four domains each of which were explored at an individual and societal level:
  - impact on humans
  - impact on animals
  - impact on farming systems
  - impact on nature and the natural order
- Animal welfare, sustainability, and the quality of meat were considered important for the future of farming and seen as potential applications areas for genome editing.
- Welfare standards in current intensive farming systems were of significant concern. Consequently, the argument that genome editing in farmed animals does not wildly differ from selective breeding practices currently employed in this system, did not provide an ethical basis for its use.
- Participants saw genome editing as a tool that should be used only if there are no other means to reach a desired outcome in farmed animals: notably to increase animal welfare and/or to maintain equitable access to meat produced under high welfare conditions.
- Participants expressed significant concerns over commercial drivers of genome editing in farmed animals, as well as the ability of governance and regulatory systems to control the technology in a way that meets public aspirations for the UK's future food system.

## Key findings

Participants framed their issues, questions, and potential ethical tensions concerning genome editing in farmed animals through four domains:

- impact on humans (e.g., in terms of the quantity and quality of meat, human health, and cost of food)
- impact on animals (e.g., in terms of animal welfare, dignity and animal rights)
- impact on farming systems (e.g., in terms of impact on farmers and business owners, and on the type of farming they wanted to see developed in the UK)
- impact on nature and the 'natural order' (e.g., in terms of environmental impact; and humans' relationship with animals).

We have summarised the questions emerging for participants in each domain in Figure 1 (overleaf).

In general, participants explored these areas of ethical questioning at an individual level (what does this mean for me and my family? What does this mean for an animal?) and a societal level (what does this mean for the future of food and farming, and the wider economic and social systems that support food production? What does this mean for future generations?).

As they explored these questions, participants' views on genome editing in farmed animals were nuanced and conflicted. They could see that there were applications of genome editing that could potentially address challenges in the farming system and tended to be more supportive of uses which promote animal welfare (and, to a lesser extent, ensuring meat remains affordable and accessible to all).

However, they also expressed significant concerns about *why* the technology was being pursued and whose interests were being served. Anxieties included how genome edited animals may be treated, whether genome editing would drive the further intensification of agricultural systems, as well as concerns

around human safety. Many participants felt genome editing held a powerful transformative potential, moving it beyond an extension of selective breeding to the point where scientists were “playing God” by adding or removing characteristics in animals that may not have otherwise been possible through evolution or selective breeding processes.

**Figure 1. Four domains of public concern and questions around genome editing in farmed animals**



People tended to be more comfortable about the potential application of genome editing in farmed animals when asking questions in the ‘individual’ space (i.e., what does this mean for me), and when considering farmed animals from the perspective of a consumer (i.e., meat as a product). The ‘societal’ space - where people reflected on food systems as citizens and considered our collective good - raised greater concerns. This space proved more powerful in shaping participants’ perceptions of the technology by bringing the ethical considerations and long term consequences for our food system more to the fore.

**Participants had a strong interest and desire to influence the way in which the food they consume is grown and reared, though at present have very limited opportunity to do so. Overall, they preferred to assess and value applications of genome editing in farmed animals in terms of whether it supported their aspirations for the UK farming systems: to create higher welfare, sustainable, healthy, affordable food - and directed their discussion to consider the ethics of such practices in this context.**

## Key findings in more depth

This public dialogue was designed to allow people to frame issues around genome editing by exploring their relationship with food, farming, and farmed animals.

**While food played a significant role in people's family and social life, people's relationship to consuming meat was complicated and ambivalent.** Irrespective of participants' diets, animal welfare was a clear concern for participants as was the wider environmental impact of rearing farmed animals. While efforts to reduce meat consumption (particularly red meat) were common, most people valued the public's freedom of choice to consume the foods they wanted.

Participants placed value on meat and fish being affordable (particularly for lower income households) and 'high quality'.

People also felt the greatest responsibility for animal welfare rested with retailers (through their power in the supply chain) and producers, with standards assured through the food regulation system. This notwithstanding, they tended to assume that cheaper meat was 'lower quality' which was synonymous with lower welfare conditions. People made uncomfortable trade-offs between affordability, quality and animal welfare when eating meat; and in practice chose to not think about the implications of such choices when buying food.

There was a high degree of unease around intensive farming methods and its impact on animal health and welfare. People wanted the meat and fish they consume to have had a "happy" and "natural" life. This included:

- space: not to be cramped or caged
- freedom: to be an animal, to exist in a way that is seen as 'natural'
- environment: to enjoy good living conditions

Intensive animal farming was not only thought to be at odds with this view of animal welfare, but was also seen to drive lower nutritional quality, over consumption, and food waste. While participants were conscious that trade-offs were inevitable to feed a large population with meat and fish at an affordable cost, their ideal scenario was one where UK livestock farming was both sustainable and higher welfare, providing consumers with affordable, healthy food.

On the whole, selective breeding practices (with chickens the exemplar) were seen part of an intensive system, making meat production more effective, efficient, and profitable – often at the expense of improving human health or animal welfare. The potential to accelerate such impacts through genome editing was a significant ethical concern. **In this context, the argument that genome editing in farmed animals does not wildly differ from current selective breeding practices did not provide an ethical basis for its use.**

More broadly, there were three **ethical frames** that participants drew on when assessing applications of genome editing in farmed animals:



1. A **consequences frame**, where participants weighed up the potential benefits or harm that could come through genome editing.
2. A **duty frame**, which related to the obligation owed to humans to ensure affordable meat for those on low incomes (including globally); relative to a duty to protect and enhance the welfare of animals.
3. A **virtue frame**, which related to the moral character of individual and collective actions. In this context, participants identified the type of food system they wanted for the UK and what this meant for the way in which livestock should be farmed.

**A virtue framing became more prominent as the dialogue progressed, as participants adopted more of a citizen-perspective and looked at the issue in terms of how to create a better society. Their central question became: *will applying this technology take us closer to, or further away from, the agricultural systems we should aim for in the future?***

In considering public views towards genome editing in farmed animals, it is instructive to look at whose interests it is seen to serve and who / what is impacted through applications of the technology. Discussions with participants identified the following four groups:

1. **Human beings** – this focused on the safety of consuming gene edited meat and the ability of regulators to foresee future impacts. Participants believed that genome editing had the potential to increase the productivity of farmed animals but expected this to come at a cost which would be borne either by consumers (leading to equity concerns) or by farmers (leading to a negative impact on standards, and the potential patenting of animals). Using genome editing to alter the quality and nutritional value of meat was not something that most people felt was desirable, instead feeling that the focus should be on encouraging people to eat a suitably diverse range of food (including protein sources beyond meat). Should gene edited meat products enter the market, there was a desire for transparency in clear labelling to support consumer choice.
2. **Farmed animals** – the potential for genome editing to reduce diseases which affect farmed animals and promote animal welfare were, in principle, benefits that resonated with participants. However, there was a strong underlying concern that creating more resilient animals would facilitate the greater intensification of farming practices which may have negative welfare implications and result in new diseases.
3. **Food system/s** – with strong governance and control, genome editing did offer the potential to support a positive change in the way in which livestock are farmed in the UK for the better. But given the pressures of global farming systems, market-led mechanisms were likely to incentivise a “race to the bottom” in terms of the sustainability of agricultural systems, and ultimately impact the quality and safety of the meat we consume.
4. **Nature and the natural order** – humans’ instrumental use of farmed animals was an uncomfortable truth for people. Boundaries were drawn between breeding characteristics that could have occurred ‘naturally’ vs those that could not (with the latter particularly problematic for participants). However, public concerns were not only about “playing God”, but also about developing traits that felt intuitively wrong. For example, producing very large animals that may struggle to support their weight was deemed to be ethically wrong (even if produced through genome editing process akin to selective breeding).

Overall, the transformative potential of genome editing did not sit easily with the idea of it being a “faster,

better” extension of existing farming practices. Specifically, some of the claimed benefits of the technology (from the eradication of diseases, to feeding the planet) were not believed to arise from incremental changes that could have occurred naturally. There were also concerns about nature ‘striking back’ – and that an application of genome editing to resolve one issue may create other unforeseen problems, given the complexity of natural systems.

**The most acceptable reason for applying genome editing technologies to farmed animals was to improve animal welfare. Participants indicated this would need to be accompanied with a move away from intensive models of livestock farming and a different governance system, with animal wellbeing (as well as human safety) at its heart.** This would have broader beneficial impacts on the food system. For example, improving disease resistance to enable farmed animals to be raised in more ‘natural’ outdoor conditions would improve their quality of life and, as a secondary benefit, was believed to improve the quality of the meat or fish produced. Participants in this dialogue typically desired a UK food and farming system grounded in sustainable, higher welfare processes – even where current consumer behaviour did not align with these values.

**Though a less dominant view, genome editing was seen as having the potential to maintain access to meat and animal products** in the face of increasing demand through growing populations. Again, there were conditions under which this was seen as being acceptable, notably having regulations to guarantee safety for humans and animals, and ensuring that it does not further intensify UK livestock farming practices or reduce animal welfare.

However, **overall, genome editing was seen by participants as a powerful and invasive technology which should only be pursued where other courses of action could not lead to the desired outcome.** There were significant concerns that commercial realities and the pace of change would make it very challenging for policymakers and regulators to oversee this process effectively.

This dialogue has demonstrated that the public have priorities for food and farming and are able to articulate and develop their views on the purpose and ethics of genome editing in farmed animals in this context. This was, however, a relatively brief engagement with a limited number of people, which means that we have not been able to further explore the ways in which genome editing in farmed animals *may* contribute to participants’ aspirations for the UK food system.

Beyond this dialogue, wider public discussion and policy has focused predominantly on safety and the extent to which genome editing can be viewed as an extension of selective breeding. Safety is a very important issue and a core concern of people in this dialogue. However, it is only one part of a wider, deeper discussion around the future of food and farming that the public – as illustrated through this dialogue - are interested and able in contributing towards. Changing rather than perpetuating an unsustainable food system is a fundamental public concern. **In this context, there are reasons not to base regulatory decisions that potentially lock in technological pathways for the future of farming based on framing gene editing of farmed animals as a question of safety and harm, or the extent to which it is seen as an extension of ‘traditional breeding’.**

# 1. Dialogue background

## 1.1. Context

The factors shaping public debate around the potential uses of genome editing in farmed animals are broad and complex. The technology is being heralded as one of the most significant breakthroughs in biotechnology in recent years,<sup>9</sup> using enzymes as ‘molecular scissors’ to make targeted changes to the genome of a living organism – by inserting, deleting, modifying, or replacing fragments of DNA and manipulating gene expression and function. Genome editing applications for farmed animals range from increasing yield and productivity by promoting animal muscle growth, to improving their health and welfare, by engineering resistance to viral infections.<sup>10,11</sup>

However, the potential use of biotechnology in agri-environmental systems in the UK has a long and often acrimonious history – notably the GM crop and food controversies in the late 1990s and early 2000s. There has been much written on this issue, which has focused on a disconnection between expert and lay framings around the governance of the technology.<sup>12,13</sup> Specifically, risk-based regulatory scientific assessments of GMOs on human health often miss a broader set of social considerations beyond harm – including the purpose of the technology, who benefits from it, and the wider implications for food and farming systems.

A shadow from these controversies has been cast over the initial framing of debates around genome editing. From January to March 2021, the Department for Environment, Food and Rural Affairs (Defra) launched a consultation on the regulation of genetic technologies.<sup>14</sup> A key focus of this consultation was whether the regulations around genome editing applications for farming should diverge from European legislation which has treated the technology like genetically modified crops.

Specifically, Defra sought to gather views on whether gene edited organisms possessing genetic changes which could have been introduced by traditional breeding should be excluded from regulations of genetically modified organisms (GMOs). It also sought to establish whether existing non-GM legislation is sufficient to deal with all organisms irrespective of the way that they were produced or whether additional legislation is needed. As important as these issues are, by focusing the debate on a narrow set of technical concerns there is a risk that wider considerations around how such technologies may be used and governed could be overlooked.

The purpose of this dialogue was to create a space for members of the public to help frame the issues around genome editing in their own terms and to enable reflection on the attendant ethical issues surrounding its application in farmed animals. The dialogue was set up to initiate such a conversation, helping to map the terrain, as well as identify areas for future public debate.

<sup>9</sup> CRISPR everywhere. *Nature* 531, 155 (2016). <https://doi.org/10.1038/531155a>.

<sup>10</sup> Gratacap, R., Wargelius, A., Edvardsen, R. and Houston, R. (2019). Potential of genome editing to improve aquaculture breeding and production. *Trends in Genetics*, 35, 9, pp. 672-684.

<sup>11</sup> de Graeff, N., Jongsma., K., Johnston, J., Hartley, S. and Bredenoord, A. (2019). The ethics of genome editing in non-human animals: a systematic review of reasons reported in the academic literature. *Phil. Trans. R. Soc. B* 374. Available at: <https://royalsocietypublishing.org/doi/pdf/10.1098/rstb.2018.0106>

<sup>12</sup> Grove-White, R., Macnaghten, P., Mayer, S. and Wynne, B. (1997). *Uncertain World: Genetically Modified Organisms, Food and Public Attitudes in Britain*, Lancaster: IEPPEP, Lancaster University, in association with Unilever

<sup>13</sup> Jasanoff, S. (2000). Commentary: Between risk and precaution—reassessing the future of GM crops. *Journal of Risk Research*, 3 (3), 277–282.

<sup>14</sup> <https://consult.defra.gov.uk/agri-food-chain-directorate/the-regulation-of-genetic-technologies/>

## 1.2. Aims and objectives

Basis Social, working in partnership with Bright Harbour, was commissioned to engage members of the public in a dialogue to identify and explore issues of public interest and concern raised by genome editing in farmed animals in the UK.

### Specific objectives were to:

1. Provide opportunity for citizens to explore the question of genome editing technologies in farmed animals within the framing that makes sense to them – for example, not assuming that ‘safety’ is their primary concern
2. Explore and understand participants’ views on the adoption of genome editing technologies in farmed animals
3. Identify areas of significant public interest and concern with the application of new genomic technologies in farmed animals, and explore citizens’ assumptions about the key issues identified
4. Disentangle and delineate the complex factors influencing public attitudes and interests
5. Understand the values and principles that underlie participants’ views, mapping these and the concepts, arguments, and language relevant to public discussion of genome editing and farmed animals
6. Share findings to inform current and future research, regulatory, industry and farming practices, and policy debates.

Findings are explored next and our methodological approach for the dialogue is provided in [the annex](#).

## 2. Current relationships with farming and farmed animals

### Summary

- People's relationship with food, farming, and animals is emotive. Affective reasoning is influential in shaping views on genome editing.
- Most participants habitually ate meat, while at the same time expressing a disconnection from the meat they consume.
- The exception to this were vegans and vegetarians, who had typically chosen not to eat meat because of concerns about animal welfare, animal rights, and/or the environmental impact of meat production.
- Three key drivers for meat and dairy choices for most participants were price, quality, and convenience.
- Participants placed value on meat and fish being affordable and healthy, though acknowledged these needs were often in tension.
- Labels (organic, free range), price, and locally sourced food are used for indicators of meat and dairy quality.
- People's relationship to consuming meat was complicated and ambivalent. Irrespective of diet, animal welfare was a clear concern for participants as was the wider environmental impact of rearing farmed animals.
- Despite this, most participants valued the public's freedom of choice to consume the foods they wanted.
- Intensive farming was a significant concern for people, creating negative impacts on animal welfare and the environment. People want future farming systems to create higher welfare, sustainable, healthy, affordable food.

We began the dialogue with a brief exploration of participants' current relationships with farming and farmed animals, exploring the role of meat in their diets and immediate associations and questions they have about farmed animal practices. This helped us to:

- understand the range of associations participants had about farming and farmed animals in general, as these were likely to influence views on genome editing
- ease participants into the dialogue, ensuring that their first discussions centred around something that was easy and comfortable to talk about, before getting into more detail on genome editing.

### 2.1. Consumption of meat, fish, and animal products

Before participants met us, or each other, we asked them to produce short videos exploring their relationship with food, and the role that meat, fish, and dairy plays in their lives. It was clear that people's relationship to what they eat is far more complicated than that of 'consumer' to 'product'. Food matters – it was tied to participants' family and social lives, traditions and culture, and their values. Overall, **participant's relationship with food, farming and animals is emotive and this affective reasoning was very influential in shaping views on genome editing.**

*“I prioritise food in my life. I suffer from asthma which has not been able to cure through antibiotics or steroids. But I found success through changing diet and going organic.” (Workshop 1)*

*“Food is a big thing in my family. With my parents, their way of showing love is through food.” (Workshop 1)*

Most participants ate meat, fish, and animal products. Meat was valued as an important source of protein, as a meal staple that made it easy to feed a family quickly, and as a source of enjoyment and pleasure. **While eating meat was seen as an accepted and normal part of a UK diet, people expressed an ambivalent and uneasy relationship with meat production.** Supermarkets and marketing ‘sanitised’ the production process and kept the conditions for farmed animals out of mind.

*“Behind the supermarket packaging, you don’t know how this animal was treated.” (Workshop 1)*

Vegan and vegetarian participants had chosen not to eat meat because of concerns about animal welfare, animal rights, and/or the environmental impact of meat production. Often, they recalled a seminal moment which changed their relationship with food, and typically drove deeper emotional connection with farmed animals, or which heightened their sense of risk and urgency around the sustainability of meat consumption.

*“I was a farmer, and I’m still surrounded by farmland. And I became vegan one night when they were separating the lambs from their mothers. My dog was so distressed hearing it, and I was looking at my dog – thinking, ‘well, if I know you can feel all this, why are those lambs any different?’ And that was it for me, I went vegan and never went back.” (Workshop 2)*

When participants talked about their meat and dairy choices, the three main drivers were price, quality, and convenience. People’s finances varied, but generally all were mindful of how much they were spending on food, with affordable, healthy eating a key need. **Higher priced items were associated with higher welfare standards which in turn were seen as better for human health, though such items were often beyond means for those on a tight budget.** As well as health and goodness, ‘quality’ included associations around taste, texture, and appearance.

*“You have to buy free range – the cheapest eggs look horrible.” (Workshop 1)*

*“You can go right up to higher welfare beef, but then you’re paying something like £60 for two steaks, which is a bit much.” (Workshop 1)*

**Participants used labelling and branding as shortcuts for meat and dairy quality.** Organic labels signalled food would be ‘healthier’, with lower environmental impact and high welfare standards; free range (typically chickens) provided reassurance around how animals were kept. Despite this, participants were also aware that the food they ate was marketed to reassure them, without necessarily reflecting animal treatment or product quality.

*“Organic is better for my health – it doesn’t have lots of hormones in it.” (Workshop 1)*

*“I’m not rich or anything but I will prioritise organic over not organic because I don’t want GMO.” (Workshop 1)*

*“I’m a total sucker for marketing – for example, if it is says it’s organic, or it’s ‘happy hens’.” (Workshop 1)*

‘Local’ was also a shortcut for quality and ethically reared food. Participants valued “knowing where your meat comes from” when they shopped locally. As we explore below, this preference for local food was in part a response to disquiet about large-scale industrialised farming, often equated to ‘intensive farming’ by participants.

**Views and attitudes shifted when participants began to think about ‘animals’ during the dialogue rather than ‘meat products’ for consumption.** This shift focussed greater attention on animal sentience, intelligence, and emotions. Thinking in terms of ‘animals’ also opened questions of animal-human relationships and people’s place in nature.

*“As a supposed higher intelligent being we should be caring more for our nature and animals not less. We should be the caretakers not the jailkeepers.” (Discussion Board)*

People moved from viewing food as a ‘consumer’ towards that as a ‘citizen’ through the dialogue. The former is characterised by consumption and is individualistic. The latter was characterised by considering the farming system, rather than the product, with a focus on the consideration of others. These frames promoted different considerations around genome editing in farmed animals.

## 2.2. Views and attitudes about farming systems

People recognised that farmed animals existed to feed humans and modern farms were set up on an industrial scale to meet this need. Rural participants especially saw farming as a business concerned with producing food.

*“I can see both points of view. I’m living in a rural area and I grew up on a farm. You just saw farming as a necessity. To feed the population you need farms of a decent size” (Workshop 1)*

While understanding this purpose of farmed animals, it did not negate wider welfare and environment concerns. Recent documentaries, notably *Cowspiracy* and *Seaspiracy*, were cited as making people consider the true price of industrialised farming, as well as raising questions about our duties to treat animals with dignity. Claims to have reduced meat consumption (particularly red meat) for health and environmental reasons were common during the dialogue. Rural participants also lamented the loss of smallholding agriculture run by “people who cared about the animals”. **Overall, modern food production was seen as very problematic: efficient yet wasteful; driving over consumption and devaluing food.**

A key concern for participants was how the future of farming might minimise intensification and negative environmental impact, ensure higher standards of animal welfare, whilst feeding a growing population affordably.

*“I would like us to move away from intensive farming, but I believe it’s driven by market and international pressures. We’re being forced into the position.” (Workshop 1)*

*“We are disconnected from animals. We say we are a nation of animal lovers, but that is not reflected in how we act and treat farmed animals. People just put it out of mind – and we need to bridge that gap. Any future farming systems will need to be mindful of this and not further divorce us.” (Workshop 1)*

There was scepticism as to the extent this could be achieved through technical solutions, without significant changes to consumer behaviours and incentives for farmers.

### 2.3. Initial understanding of genome editing

Building on initial discussions around technologies, at the end of Wave One we explored participants' understanding of genome editing and what it might involve. Just under half of participants reported having heard of genome editing prior to their involvement in the public dialogue, and very few mentioned having learned anything in depth about the subject prior to taking part. While awareness of what genome editing involved was basic, participants often provided relevant descriptions.

*"I think gene editing is changing the genetic structures of animals to remove any negative things from an animal that are not needed or are undesirable and adding traits that are more favourable." (Workshop 1)*

*"Gene editing means selective breeding, using technology to make changes quicker than through traditional breeding, end result is 'better' food, less waste, etc." (Workshop 1)*

After watching a short film on the technology, participants were asked what further information they would like to understand and identify stakeholders to hear from, including areas of ethical concern. How participants related to these themes is explored next.



## 3. Ethical values and frames

### Summary

- Participants drew on three ethical frames on when assessing applications of genome editing in farmed animals: consequences, duties, and virtues.
- At the beginning of the dialogue, most people adopted a consequences frame, considering the potential benefits or harms that could result from genome editing in farmed animals.
- Through **a consequences frame**, participants:
  - were concerned about immediate negative outcomes (for humans or animals), and longer-term impacts and spillover effects.
  - felt the risks of genome editing seemed to outweigh rewards, with most benefit accruing to companies implementing the technology instead of animals, consumers, farmers, or society.
- A duty frame related to the view that using animals for human benefit creates a duty for humans to consider the welfare of these animals, as well as our duties to feed other humans.
- Through **a duty frame**, participants:
  - believed genome editing in farmed animals had the potential to improve animal welfare in certain contexts, such as disease prevention. However, participants also believed genome editing in farmed animals had the potential to worsen conditions for animals by encouraging greater intensification of farming. In consuming meat from farmed animals, participants felt it was beholden on people to safeguard and promote high welfare standards.
  - sought a better a balance between affordable, health eating, and animal welfare.
- A virtue framing became dominant as the dialogue progressed, especially as people reflected on the type of food system they would like to see in the UK.
- Through **a virtue frame**, participants:
  - expressed scepticism about the unfettered role of the market developing genome editing in ways that would improve animal dignity, ensure equitable access to food/meat, and minimise environmental impact.
  - wanted animal welfare to be more central to the governance of genome editing in farmed animals (and fundamental to a ‘good’ food system), with tight checks and balances (e.g., licensing, audits) on potential use in certain specified applications.
- Views were mixed as to the long-term potential of the genome editing in farmed animals, due to concern over exacerbating intensive farming systems, and whether undesirable impacts can be anticipated and managed.
- The ability to govern the technology in way that brought about virtuous outcomes was a significant concern for public acceptability.

### 3.1. The influence of ethical frames

This section is based on the research team’s analysis and interpretation of what was discussed throughout the dialogue process. While there are many ethical theories, based on our analysis of the discussions, we have characterised participants’ responses in terms of three common frameworks.<sup>15, 16</sup>

1. **A consequences frame**, which relates to the good and bad consequences of an action.
2. **A duty frame**, which relates to our duties and obligations to perform or refrain from a given action.
3. **A virtue frame**, which relates to the moral character of individual and collective actions, and the kind of society we want to create.

Depending on the frame through which people assessed genome editing in farmed animals, different considerations around the application of the technology came into focus.

Genome editing in farmed animals through a **consequences frame** considered the potential good or harm that could come to humans and animals. These assessments were influenced by factors including trust in technology and science, the efficacy of safeguarding mechanisms, and the relative weight placed on the importance of human needs over that of animals.

At the outset of this dialogue, most people adopted a consequences frame when considering genome editing. They discussed the potential benefits (including disease reduction, increasing access to affordable and quality meat, improvements to animal welfare, and helping to tackle climate change) and weighed these up against the potential risks. Risks were wide-ranging and are discussed in detail in [Section 4](#).

While participants were concerned with immediate negative outcomes (for humans or animals), it was the longer-term impacts and spill over effects that worried participants most – such as the alterations to genes creating susceptibility to other diseases. There was a strong sense for many that “adding more technology” to fix problems of human creation had the potential for backfire; and that trying to “outsmart mother nature” was likely to create problems, rather than solve them. There was little confidence that scientists, regulators, and society more generally could foresee how genome editing in farmed animals might lead to unintended, negative consequences.

In weighing up the perceived pros and cons, the level of risk was seen to outweigh the potential reward, with the main beneficiary of genome editing in farmed animals seen to be the companies involved in developing and applying the technology.

*“It seems too powerful to be Plan A or Plan B. It has too many unintended consequences.”  
(Workshop 3)*

*“The companies doing this are doing it for money not animal welfare.” (Workshop 3)*

Considering genome editing in farmed animals through a **duty frame** focused on the obligations owed to animals and humans. At its heart was a tension between a duty to treat animals well and with dignity; and the duty to feed people affordably. Gene editing was seen to offer both promise and problems across both sets of duties.

<sup>15</sup> Green, J., Ginberg, M., et. al. A Framework For Making Ethical Decisions. Brown University, 2013

<sup>16</sup> Reiss, M. (2010). Ethical thinking. In A. Jones, A McKim, M. J. Reiss (eds.), Ethics in the Science and Technology Classroom: A New Approach to Teaching and Learning, Sense, Rotterdam, 7–17

In terms of our **duties to animals**, potential applications to improve the health, safety, and conditions in which animals were kept were seen as significant benefits. However, those very improvements could also lead to the worsening of conditions for farmed animals, as businesses took advantage of genetically stronger livestock.

*“If it stops the animals from suffering then it’s obviously a benefit.” (Workshop 3)*

*“... this will enhance animal welfare, we will get better quality food introduced to the food chain. Certain unnecessary characteristics such as horns on farm animals can be removed. They are removed after birth anyway so why not do it in a pain free way?” (Discussion Board)*

*“The farmers will take advantage of the animals by not looking after them properly because they can get away with it.” (Workshop 3)*

*“If the animals are going to become more resistant to things, then you’re not going to worry about keeping them in a clean environment. And they’re not going to see a vet regularly so they’re not going to be treated regularly.” (Workshop 3)*

We purposefully recruited several participants who were vegan or vegetarian, both as a way of ensuring that those with such views in the UK were represented, and in the light of increasing trends within the UK towards reduced meat consumption.<sup>17</sup> They were typically among the most ardent in voicing concerns around the use of genome editing in farmed animals, although they were by no means the only participants who expressed strong reservations or concerns. For vegan and vegetarian participants, the farming of animals for food was wrong. They indicated that animals are sentient creatures and stated that we have a duty to protect them from harm and distress given they do not have a voice in the decision.

*“How is it better for animal welfare? They don’t get a say in it. It’s for our welfare. We again decide what’s happened.” (Workshop 3)*

In terms of our **duties to humans**, the need to feed a growing population fairly and equitably was a significant concern. There was a desire to ensure access to good quality, affordable meat, fish, and animal products, though there was an acknowledgement that this often came at the expense of animal welfare. Lacking agency to change the current farming system, a fatalistic view was common when expressing such duties: animal farming may not be nice, but it is necessary to provide people with affordable access to meat. An ethical hierarchy (with the needs of humans above animals) was also used to legitimise these positions.

*“We have a lot of food poverty in Britain – people need to be able to afford to eat.” (Workshop 1)*

*“The animals are being slaughtered anyway. It’s not nice, but it happens.” (Workshop 3)*

*“Slaughter is not a nice thing for an animal, it just has to be done quickly to get it done. An animal is an animal.” (Workshop 3)*

While genome editing could play a role in increasing meat production, it was less clear how it would change current dynamics in the food system towards the treatment of animals, and if anything may serve to accelerate more intensive (and less desirable) farming practices. There were further concerns around food production uses, which are explored in [Section 4](#).

<sup>17</sup> RAND (2020). Food consumption in the UK. Trends, attitudes, and drivers. Available at: [https://www.rand.org/pubs/research\\_reports/RR4379.html](https://www.rand.org/pubs/research_reports/RR4379.html)

Genome editing in farmed animals through a **virtue frame** considered the moral character of actions, both at an individual and societal level. People sought a farming system grounded in sustainable and higher welfare processes, which provides affordable, healthy food. Genome editing could play a role in supporting this, if it was applied in such a way that guarded against further intensification of farming practices.

For example, genome editing in farmed animals could enable rearing in more ‘natural’, outdoor conditions. This would improve animals’ quality of life, and, in the view of many participants, the quality of the meat or fish produce in terms of taste and nutritional value (which were associated with free-range and organic farming approaches).

*“The part of making them more resistant to disease, like Avian influenza... If you solve that, would they actually be outside and have a more decent life? On paper that sounds amazing.”*  
(Workshop 3)

Despite this promise, the influence and interests of business were again felt to inevitably lead to the technology being employed in ways to maximise profit. This was seen to increase the likelihood for genome editing to create conditions under which animal welfare would be compromised, and supporting the further intensification of farming practices.

The three ethical frames described above were variously used throughout the dialogue process and influenced individual perceptions about the rights or wrongs of genome editing. However, **as the dialogue progressed more participants adopted a ‘virtue ethics’ framing.**

**Specifically, the virtues of the purposes of gene editing were a critical condition for its use in farmed animals. The same purpose – for example, making an animal hardier – could be used for reasons that are good (rearing outdoors) or bad (enabling it to withstand poorer living conditions). The ability to govern the technology in a way that brings about virtuous outcomes was hence a significant concern for public acceptability.**

## 4. Views about genome editing in farmed animals

### Summary

- There are four domains highlighted as potentially being impacted by genome editing. Concerns within each domain are as follows.
- **1. Human beings:**
  - It is not possible to foresee the health consequences of consuming genome edited meat.
  - While genome editing could help support more affordable food, there was concern companies would take commercial advantage of a new food system at society's expense.
  - The potential for genome editing to improve the quality of meat was less supported.
  - Participants felt that transparency and choice was important should genome edited food be sold for public consumption.
- **2. Farmed animals:**
  - Promoting animal welfare via disease resistance was the most compelling benefit of genome editing in farmed animals.
  - However, changing the current farming systems would be preferable to changing the animal to fit the system.
  - Participants were opposed to genome editing in farmed animals being used to create more docile animals.
- **3. Our food system:**
  - While participants acknowledged that genome editing in farmed animals had the potential to create more sustainable farming methods, economic forces shaping the technology were likely to lead to intensive and unsustainable farming systems, dependent on the technology.
  - Participants expressed significant concerns over commercial drivers of genome editing in farmed animals, as well as the ability of governance and regulatory systems to control the technology in a way that meets public aspirations for the UK's future food system.
- **4. Nature and the natural order:**
  - Participants made a distinction between applications of genome editing in farmed animals that could have 'naturally' occurred and those which could not, with more acceptance for the former.
  - The transformative potential of genome editing did not sit easily with the idea of it being a "faster, better" extension of existing farming practices
- The acceptability of genome editing in farmed animals did not relate to the technology itself, but rather to the purposes of its application.
- The most acceptable applications of genome editing in farmed animals were those which supported sustainable and higher animal welfare change to current agricultural practice, though even for these purposes, participants felt genome editing technology should only be used where there are no other means to achieve the desired outcome.

## 4.1. Exploring public views about genome editing in farmed animals

In the previous sections of this report, we have already seen that participants' views towards genome editing in farmed animals are complex and nuanced, relating not just to the technology but to human relationships with animals, the food system, and technology more broadly, and an instinctive sense of right and wrong. In considering public views towards genome editing in farmed animals, it is instructive to look at who or what is seen to be impacted through the application of genome editing technologies to farmed animals, which in turn involves considering the purpose of the technology, whose interests it is seen to serve, what risks it poses, and to whom.

The dialogue explored these issues through several potential use cases. These covered the following areas:

- Improving lactation performance (the quality and/or quantity of milk produced)
- Improving meat production (the quality and/or quantity of meat produced)
- Increasing the resistance of farmed animals and fish to diseases
- Improving animal welfare through, for example, removing characteristics of farmed animals which can lead to their harm (such as creating polled cattle)
- Addressing human allergies to current meat and animal products

When discussing these applications, the following domains were identified as potentially being impacted by genome editing in farmed animals:

1. Human beings
2. Farmed animals
3. Our food system/s
4. Nature and the natural order

Figure 2 (below) illustrates the range of questions posed in respect of each of the four domains that were seen as potentially impacted by genome editing. These questions help to address the issues which participants felt relevant to consider when thinking about the application of genome editing in farmed animals. We will explore each of these areas in turn to understand participants' views towards genome editing in farmed animals.

Figure 2. Four domains of public concern and questions around genome editing in farmed animals



#### 4.1.1. Human beings

One of the first questions participants asked when considering the application of genome editing technologies in farmed animals was the safety impact it might have on the meat, fish, and animal products that they consume. In polling of our participants conducted at the outset of the third workshop, over half of participants (54%) expressed concerns at the risks that genome editing in farmed animals might present to human health.

**Altering a creature's DNA was seen as something which carries with it a risk, though how much of a risk remained unclear to people.** For example, some participants expressed concerns that eating gene edited meat could have unforeseen impacts on human DNA. Participants' discussions drew on examples such as COVID-19, BSE (bovine spongiform encephalopathy) and the use of Thalidomide as

a treatment for morning sickness to illustrate that there will “always be unknown side effects” of human and scientific interventions. Wider practices within the food industry (for example, promoting foods high in fat, salt, or sugar, or the extensive use of artificial additives) did not create confidence that business has people’s wellbeing at heart.

In this context, **participants did not feel it was possible to foresee the potential health consequences for humans of consuming genome edited meat. Given the likelihood for widespread application to food produce and the transformative potential of the technology, the concern was that the resulting health risks could be serious.**

*“... we’ve had it before with Thalidomide drugs, those are wonderful drug everyone was taking Thalidomide and then look what happened. Are deformities going to happen in people, or illnesses?” (Workshop 3)*

*“Definitely I wouldn’t encourage children to have it for a meal. One huge mistake if that is allowed to happen in this country. It is bad enough as it is when our diet is full of chemicals, synthetics, preservatives, additives.” (Discussion Board)*

In the light of increasing populations and demand for meat, the potential to improve yield was discussed – from increasing the volume of meat produced by a given animal through altering relevant genes, or from creating greater efficiencies in the system. The primary advantages of increased yields to people were seen in terms of reductions to the cost of meat and increased access. These were seen as potential benefits both for UK consumers and feeding the global population.

*“Reducing the cost of food is very good... This will take the pressure off low income families.” (Workshop 3)*

*“...a big positive that countries, particularly developing countries, will be able to provide access to food”. (Workshop 3)*

**One of the concerns of the current agricultural system was that it tended to create a dichotomy between very expensive, high welfare, high quality food; versus cheap, low welfare, poor quality food. This was driven by the desire to maximise profits at either end of the spectrum.**

*“To me it seems we have the choice between organic meat and mass production meat injected with lots of bad things. From one extreme to another - either very expensive or cheap meat. Either super healthy or unhealthy meat.” (Discussion Board)*

**A compelling argument for gene editing is that it could help support affordable, quality food for all.** Counter to this was the expectation that companies involved in developing the technology would ensure that the financial costs involved were passed on to farmers, and new ways would be found in the system to create financial value and profit. This pressure could lead farmers to “cut corners” by finding ways to save money and make efficiencies in the process of farming livestock.

Improving the quality of meat, fish, and animal products was also discussed. While improvements in taste were largely discounted and seen as unnatural, other outcomes which conveyed health benefits to humans were discussed, including the potential for gene edited farmed produce to contain additional vitamins to provide added nutritional value, or for produce which alleviates human allergens or acts as a vehicle for improving human resistance to diseases that can be passed from animals.

*“If it can make animals and humans healthier it’s a step in the right direction.” (Workshop 3)*

*“This is the way forward for improving quality of life of farmed animals and also quality of product.” (Discussion Board)*



There was discomfort with the idea of genetic fortification. Vitamins and minerals were seen as naturally occurring and accessible via a healthy, balanced diet. Rather than edit the genes of farmed animals to boost vitamins or minerals, people should eat foods where they were naturally present.

There was greater support for removing allergens or decreasing antimicrobial resistance through reducing the need to use antibiotics in farmed animals – although, again, these use cases were not compelling to many participants, given the complexity of biological systems and potential unintended consequences.

Should regulated, gene edited products enter the market, there was an expectation amongst participants that they would be clearly labelled and potentially sectioned out, much like how organic products are currently marketed by some retailers, to support informed purchase decisions by consumers. Similarly, there was a desire expressed that genome edited meat, fish, and animal products should not become the de-facto norm, reducing the choice, and increasing the cost of non-gene edited produce. **Transparency and consumer choice are important conditions should genome editing in farmed animals take place.**

*“What gave me peace of mind is that most of the regulations that currently apply to the meat market will remain in place to approve the product in case of gene editing.” (Discussion Board)*

#### 4.1.2. Impact on farmed animals

**One of the key proposed benefits of genome editing in farmed animals is the potential for reducing disease in livestock and introducing or removing traits to convey welfare benefits for animals. These benefits resonated strongly with participants.** Participants reflected positively on the possibility that genome editing could reduce animals’ premature deaths, pain, and suffering from more “naturally occurring” diseases or animal behaviours. In polling of our participants conducted at the outset of the third workshop, 41% of people felt that genome editing could be beneficial for animal welfare.

*“I’m concerned about the animal’s welfare, but I can see that there could be a lot of benefits for them as well as long as the proper precautions are taken.” (Discussion Board)*

However, the qualification to this was that if these diseases or behaviours were a result of the conditions in which animals were being farmed, then it would be preferable to change the system than change the animal. There was a strong feeling of the ‘unfairness’ in genetically altering animals to alleviate such practices.

*“But with animals, maybe to help their welfare (gene editing would be acceptable), but I think we could do it naturally. We are remedying a problem we are creating for ourselves.” (Workshop 3)*

*“It’s not that we need to edit the animals so that they grow quicker. No, we need to fix the farming model that exists because of the societal model that we have”. (Workshop 3)*

Additionally, participants saw increasing disease resistance as potentially enabling a more intensive farming system which (beyond the welfare concerns discussed in [Section 3](#)) could also create the conditions in which new, more resilient, and dangerous diseases could emerge.

*“Where you lower the welfare, you will have new diseases. It’s inevitable.” (Workshop 3)*

**Participants were strongly opposed to the use of genome editing to produce more docile farmed animals, or farmed animals that might be less ‘stressed’ by the breeding or slaughter process. Of the use cases explored during the dialogue, these were by far the least acceptable.** Participants did not see these uses as ways of benefiting the farmed animal, but instead as means to serve the

interests of humans through making us “feel better” about the conditions and processes by which meat is produced.

*“If cows are more docile while being killed. Just because I am more docile, doesn’t mean I am less distressed mentally. The animal might be as scared but because not exhibiting physical fear symptoms, that makes me very sad.” (Workshop 3)*

*“Taking away an animal’s way to feel and show stress will give people the false idea that they do not need to care for them because they do not feel and will stop then being seen as a sentient being.” (Discussion Board)*

#### 4.1.3. Our food system/s

As highlighted throughout this report, there was a high level of concern and dissatisfaction with intensive farming practices. These concerns related predominantly to the impact on animal welfare, but also to human health (e.g., obesity), sustainability, and environmental impact.

Participants acknowledged that genome editing had the potential to open the way for more sustainable livestock production, where animals were raised in more ‘natural’ ways which also minimised their carbon footprint. Genome editing was seen as facilitating this through promoting greater resilience and disease resistance in farmed animals, reducing the need for controlled conditions and veterinary medicines.

This did, however, lead participants back to considerations around why genome editing was needed in the first place. **If the aim was to enable people to continue to consume meat – accounting for increasing populations, and the need to address climate change by reducing farming-related emissions and carbon footprints – then many participants felt that genome editing is simply propping up an unsustainable system.** Participants indicated that the issue to be addressed is to reduce the overall demand and consumption of meat, to enable more sustainable and lower impact forms of livestock production.

*“If you’re serious about saving the planet and improving people’s health then you’ll encourage the whole of the world to eat less meat, use less animal products and save destroying acres and acres of land to raise cattle.” (Workshop 3)*

*“It’s going to make things worse. We need to think about behaviours of reducing meat intake and not continue on the path we are on now.” (Workshop 3)*

Participants saw a relationship between intensive farming methods and negative environmental impact, for example via reductions in biodiversity. This was expected to potentially result in a vicious cycle in which reductions to the quality of soil and crops would necessitate further genetic editing or medical interventions in animals, creating a situation where it was difficult to raise livestock without using genome editing.

Participants raised several other concerns around genome editing in farmed animals and its impact on the broader food system.

The first related to the ability of regulators to keep pace with the development and application of the technology. Participants felt regulation would always be several steps behind the deployment of the technology and the resulting real-world impacts.

*“I still feel that we are not capable of foreseeing all the potential blowback from this technology.” (Discussion Board)*

The second related to concerns around the potential for large businesses to control the application of

genome editing technologies in farmed animals through patenting, leading to greater consolidation and less competition in the livestock industry, with reduced choice for both farmers and consumers.

*“I don’t see anything wrong with gene editing in itself, but it’s what people are going to do with it that I have a problem with. Big companies will see how they can get the most out of it, and they will abuse it.” (Workshop 3)*

*“The only thing that really concerns me is the regulations and patenting surrounding genome editing. The science behind it all amazes me but it needs to be controlled on a case-by-case basis and not be allowed to be used as a free for all.” (Discussion Board)*

Finally, although the focus of this public dialogue was the use of genome editing in farmed animals in the UK, participants spontaneously outlined a need to look at the technologies’ applications at a global, systems level. There was awareness that different countries’ food systems are interlinked, with crops, meat, fish, animal produce, and livestock transported across national borders. As such, **there was a concern that considering the application of genome editing in farmed animals solely within the UK would not account for the global market in which UK farmers are operating.** The use of genome editing in farmed animals in one country to create efficiencies in meat production, leading to lower prices on imported meats, was seen as having the potential to incentivise farmers in a ‘race to the bottom’ which would be bad for animals, farmers, and consumers.

*“There should be a global agreement on how to operate that because I am sure some countries would be more likely to abuse and misuse the whole thing.” (Discussion Board)*

*“We are no longer protected by the safety net of European legislation & regulation & quite the contrary, we’re rushing headlong into the arms of USA who want a trade deal which includes us accepting their agricultural practices (chlorinated chicken).” (Discussion Board)*

#### 4.1.4. Nature and the natural order

The question of what humans owe the planet, ecosystems, and other animals was one which strongly influenced many participants’ views on genome editing technologies. While a ‘natural order’ was commonly believed to exist – with humans at the top, consuming creatures below them – it was also stressed that humans, as moral beings, have a responsibility to treat animals with dignity and provide stewardship of the world’s resources.

More generally, when considering the role of genome editing in farmed animals, participants made a distinction between applications which led to:

1. Animal characteristics which could have come about ‘naturally’ through evolution or selective breeding techniques as they are commonly understood (i.e., the breeding of animals with desirable characteristics, with changes happening relatively slowly over time); and
2. Animal characteristics that are impossible or improbable via evolution or selective breeding techniques.

This distinction relates to what participants consider to be ‘natural’ genetic change versus an ‘artificial’ genetic modification. A relatively clear line was drawn for most participants between these two use cases, with the latter raising concerns around “playing God” and “interfering with nature” in a way that could have unpredictable ramifications.

*“It is a case of humans playing God and using animals as a commodity and a product. It is not considering nature, compassion or the feelings and wellbeing of the animal but only seeing the benefits to human”. (Discussion Board)*

*“Nagging feeling of scientist and geneticists acting as God in determining which genes are edited and for what overarching process”. (Discussion Board)*

*“It’s a nice idea to think that you can make everything perfect, but it’s a bit like playing God... what about future implications further down the line.” (Workshop 3)*

In this context, **the transformative potential of genome editing did not sit easily with the idea of it being a “faster, better” extension of existing farming practices.** Specifically, the more radical benefits of the technology (such as the eradication of diseases or feeding the planet) were not believed to arise from small changes that could have occurred naturally. There were also concerns about nature ‘striking back’ – and that an application of genome editing to resolve one issue may create other unforeseen problems, given the complexity of natural systems.

Moreover, while traits in line with selective breeding were controversial, they were not without problems. While chickens were highlighted as exemplars of this (fast growth, heavy weight, enlarged breast size), domestic pets, notably dog breeds, were also cited as animals whose welfare has suffered because of many years of selective breeding. Participants also highlighted that ‘nature’ has a way of ensuring balance on the wider ‘system’ and that genome editing posed a risk to this by leading to reduced genetic variation, increasing susceptibility of species to diseases, and making them less resilient.

These issues came to the fore when considering specific applications. Increasing protein production and the quantity of meat could result in animals that were unable to effectively support their own body weight. For some participants, this further gave rise to more dystopian visions of animals that are bred without certain parts of their anatomy present due to their being non-essential to the production of meat.

Rather than simply being an expression of discomfort around ‘new technologies’ per se, these concerns were grounded in dynamics of industrialised farming systems. They pointed, for example, to the experience of caged hens, or to cows injected with human growth hormone,<sup>18</sup> and other practices within farmed animal systems to help them understand what might happen and how genome editing might be used.

*“Animals growing at such fast rates that they have trouble standing or walking etc. It is not natural or ethical.” (Discussion Board)*

*“At some point an executive is going to go ‘hey, they don’t need to move do they?’ and then you’ve got a cow without legs.” (Workshop 1)*

It was clear that participants were uncomfortable with changing characteristics concerning what it means ‘to be’ a chicken, cow, or salmon.

*“I don’t want a six-winged chicken because that is taking it too far. A chicken has two wings, two feet and one head, I don’t think you should have a six-winged chicken because it takes away from a chicken what a chicken is, it’s not a chicken anymore, it’s something else.” (Workshop 3)*

Some participants likened the selection of characteristics and intentional manipulation of the gene pool to human eugenics. The concerns were that if humans were to apply this technology to farmed animals, it would not be a huge step to apply it to human beings.

*“I know they said you could edit genes in humans but could this lead to people doing things*

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<sup>18</sup> Note that this has been banned in the UK/EU since 1981, although participants may not have been aware of this.

*they shouldn't do? Think about WW2." (Workshop 1)*

*"Hitler wanted a superhuman species and tortured and killed millions of innocent people to remove the ones he did not want in his race... By taking away their right to feel they will not be able to put the fight or flight response into action. This is a natural response to protecting the self. If powerful people could do this to humans, I think in time they would. History only shows we have in a way before." (Discussion Board)*

*"I consider there seems to be no fool proof method of ensuring there will not be a "master race" creation. The world has been through many conflicts that have shown that the possibility of such a condition could be a strong final result. My opinion is that genome editing will only make this worse." (Discussion Board)*

Finally, while some farmed animals were seen as potentially more intelligent or 'sentient' than others, all were seen to have feelings and dignity, and the lack of their ability to consent to these processes meant due care and regard were needed to safeguard their welfare.

*"At the time when we are trying to get the law to recognise animal as sentient beings, genome editing makes us go step backwards, and would basically mean treating animals like property." (Discussion Board)*

## **4.2. Conditions under which genome editing in farmed animals becomes acceptable**

**Far from being either pro or anti genome editing in farmed animals, people's views are nuanced and contingent.** Over the course of three waves of public dialogue, views toward genome editing changed. In our polling of participants in Workshop 3, almost four-in-five people (78%) accepted that there were some circumstances where genome editing in farmed animals could be acceptable, though as described below, the bar for this is very high.

Through the dialogue process it was possible to disentangle conditions under which genome editing may be acceptable to people, the 'red lines' for its use, and what restrictions and safeguards they would need to see in place to support its development.

**The most acceptable applications of genome editing in farmed animals are those which support a positive change to current agricultural practice. Specifically, use for animal welfare purposes was the most acceptable application if the following conditions could be met (collectively):**

- **it supported the disease resistance of farmed animals, and**
- **it helped enable more natural outdoor rearing to reduce the intensification of UK livestock farming practices, and**
- **regulation guarantees safety for animals and humans (in the short and long term).**

While far less acceptable overall, the use of genome editing to provide affordable meat was also seen as potentially permissible if:

- it is regulated to guarantee safety for humans and animals, and
- it does not exacerbate the further intensification of UK livestock farming practices, and
- it does not reduce animal welfare within the current system.

**Participants were also largely aligned in their views that genome editing felt like an invasive technology and one which, were it to be employed to achieve benefits for farmed animals (or humans), should only be pursued where other courses of action would not lead to a similar outcome.** Notably this included making changes to the environments, practices, and processes in which animals are farmed to make these more sustainable and higher welfare.

It is important to understand that participants' cautionary views toward genome editing and the conditions placed on its potential use were not driven by being opposed to the science or the agri-environmental applications of biotechnology. **Genome editing technologies held the potential for improving the welfare of farmed animals and, for many people, that was both an exciting possibility and an acceptable use for genome editing, with the appropriate conditions and safeguards in place.**

Instead, their concerns can be seen to result from question marks around:

- the purpose
  - a lack of clarity as to exactly what challenges or issues the technology was intended to be used to tackle, and therefore who stood to benefit
  - a lack of trust in the intentions of business and what this meant for the way in which genome editing might be deployed
- the application
  - understanding the evidence base in providing a rationale that genome editing would be a safe and effective solution to the identified challenges, and that the benefits outweighed identified, quantifiable risks
- the oversight
  - scepticism in the ability of regulators to keep pace with the development and deployment of genome editing technologies; and
  - discomfort with the existing system of farming livestock and selective breeding, and a concern that this technology would entrench this model of farming.

Overall, **the acceptability of genome editing in farmed animals did not relate to the technology itself, but rather how it is applied and to what end**, the governance processes to manage this, and scepticism over how technologies may be applied for public good, given the incentives to drive to further intensification through globalised market forces.

## Postscript: future public dialogue

One of the aims of the dialogue was to consider issues that should be investigated through future public discussion on gene editing in farmed animals. Based on our findings, these include:

### Purpose

- What is the desired future for the UK food system?
- What is the role of genome editing in farmed animals in this context – i.e., what are the problem/s or prospect/s for genome editing technologies which move us towards this goal?

### Alternatives

- What are the range of alternative actions (alongside genome editing) that could be taken to address the identified problem/s or opportunities, and what are the pros, cons, and trade-offs involved in each of these?
- Should we invest in other technologies that will make the industry more environmentally sustainable?

### Knowledge

- What is the relationship between intensive and extensive farming systems and animal welfare?
- How do current regulations govern intensive farming systems?
- What research has been done on genome editing and how confident are we in it achieving its goals and not resulting in unintended outcomes?
- What are the quantifiable benefits and risks to animal welfare resulting from the use of genome editing (i.e., in terms of unnecessary deaths prevented, improvements to rearing conditions, reductions in diseases, harm or suffering achieved through genome editing as compared to potential downsides resulting from more intensive farming enabled by genome editing)?

### Policy and regulation

- How can we shift policy and regulation away from managing downstream risks, to creating the conditions under which new sustainable systems of food and farming can flourish?
- What are the procedures through which regulators would govern the application of genome editing in farmed animals to mitigate against short- and longer-term harms resulting from its use?

The acceptability and conditionalities around applications of genome editing in farmed animals is an area that should be reviewed in more detail. Notable areas from this dialogue include:

- Animal disease and antibiotic resistance
- Reducing human allergenicity to meat products
- Food quality and quantity

Overall, as the UK considers future food policy and regulatory approaches to genome editing in farmed animals, as well as the potential wider application of the technology, it will be important to account for public needs and desires at a systems level rather than simply on an application-by-application basis.

**What we found through this dialogue was that members of the public have a strong interest and desire to influence the way in which the food they consume is grown and reared, though at present have very limited opportunity to do so. There is clearly the potential for genome editing to play a role in our food future, the question is: what exact role and to what end?**

## 5. Annex - methodology

### 5.1. About public dialogue

Public dialogue is a form of deliberative group discussion which recognises the value that members of the public can add to decision-making around policy, legislation, and regulation. It is a particularly useful way of understanding public attitudes, views, and priorities around complex issues or controversial topics.

It is characterised by:

- the involvement of people from a wide cross section of society, selected to reflect a diversity of characteristics and views
- the exploration of views through a process of deliberation, where participants are given information that helps them consider and debate issues in more depth
- extended and/or reconvened sessions involving plenary and small group discussions (and supporting activities)
- the involvement of experts on relevant topics to inform people's views, and the opportunity for participants to ask direct questions of specialists in the field
- time for participants to reflect on what they have heard and discussed, and to develop their views in relation to others' views.

Public dialogue is also a means of participatory democracy in which those in power can engage meaningfully with citizens to find solutions to societal challenges.

### 5.2. Who was involved in this public dialogue?

The dialogue involved 41 participants<sup>19</sup> recruited to reflect a range of demographic backgrounds, together with the following social characteristics:

- **Faith** – to ensure representation from across the major faith groups, given the role that food and diet can play in religious culture
- **Diet** – including a mix of different diets given the potential influence on views toward the farming and treatment of animals
- **Location** – beyond geographic spread, we also sought representation from individuals across both urban and rural locations, and inland and coastal locations, given the potential impact on fisheries and farming communities
- **Attitudes toward genetic science** – to ensure a broadly even spread of participants who were positive, negative, and neutral to its uses.

The characteristics of those involved in the dialogue are summarised in Table 1.

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<sup>19</sup> 42 participants started the dialogue process, with one dropping out over the course of the three dialogue waves.



**Table 1: Participant characteristics**

Characteristic	Achieved quotas
<b>Gender</b>	<ul style="list-style-type: none"> <li>• Male (20)</li> <li>• Female (21)</li> </ul>
<b>Age</b>	<ul style="list-style-type: none"> <li>• 18-29 (11)</li> <li>• 30-44 (9)</li> <li>• 45-59 (13)</li> <li>• 60+ (8)</li> </ul>
<b>Life stage</b>	<ul style="list-style-type: none"> <li>• Students (4)</li> <li>• Young professional (under 30 &amp; working FT) (7)</li> <li>• Raising children under 16 (6)</li> <li>• Empty Nester (7)</li> <li>• Retired (5)</li> <li>• Other (12)</li> </ul>
<b>Household income</b>	<ul style="list-style-type: none"> <li>• Less than £20,000 (13)</li> <li>• £20,000-£39,999 (15)</li> <li>• £40,000-£59,999 (9)</li> <li>• More than £60,000 (4)</li> </ul>
<b>Ethnicity</b>	<ul style="list-style-type: none"> <li>• White British and Other White (28)</li> <li>• Black African and Black Caribbean (2)</li> <li>• Pakistani, Indian and Bangladeshi (11)</li> </ul>
<b>Faith</b>	<ul style="list-style-type: none"> <li>• Christianity (10)</li> <li>• Islam (3)</li> <li>• Judaism (3)</li> <li>• Sikhism (2)</li> <li>• Hinduism (2)</li> <li>• Buddhism (3)</li> <li>• Atheism (9)</li> <li>• Agnosticism (5)</li> <li>• Humanism (2)</li> <li>• Spiritualism (1)</li> <li>• Prefer not to say (1)</li> </ul>
<b>Diet</b>	<ul style="list-style-type: none"> <li>• Vegan (3)</li> <li>• Vegetarian (3)</li> <li>• Flexitarian (9)</li> <li>• Pescatarian (1)</li> <li>• Omnivore (24)</li> <li>• Dairy free (1)</li> </ul>

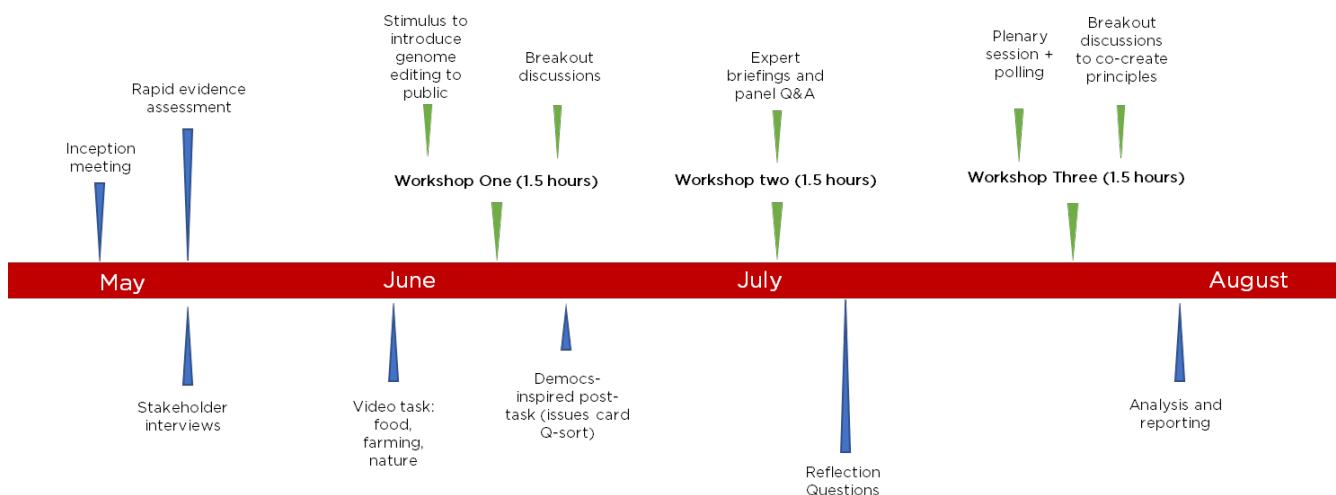
<b>Region</b>	<ul style="list-style-type: none"> <li>• England (29)</li> <li>• Scotland (7)</li> <li>• Wales (3)</li> <li>• Northern Ireland (2)</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>• Rural inland (11)</li> <li>• Rural coastal (6)</li> <li>• Urban inland (14)</li> <li>• Urban coastal (10)</li> </ul>
<b>Attitudes to genetic science</b>	<p>'I am comfortable with the idea of humans using genetic science to change the world around us'.</p> <ul style="list-style-type: none"> <li>• Agree (12)</li> <li>• Neutral (13)</li> <li>• Disagree (11)</li> <li>• No opinion (5)</li> </ul>

All participants were recruited via free-find methods by qualitative recruitment specialists Roots Research. Participants were provided with a detailed information and consent form outlining the purpose of the public dialogue, what their participation would involve, and how their data would be managed and used. Participants each received an incentive of up to £180, which varied depending on their participation in pre/post-workshop tasks and their involvement in all three waves of the public dialogue.

### 5.3. How we ran the dialogue process

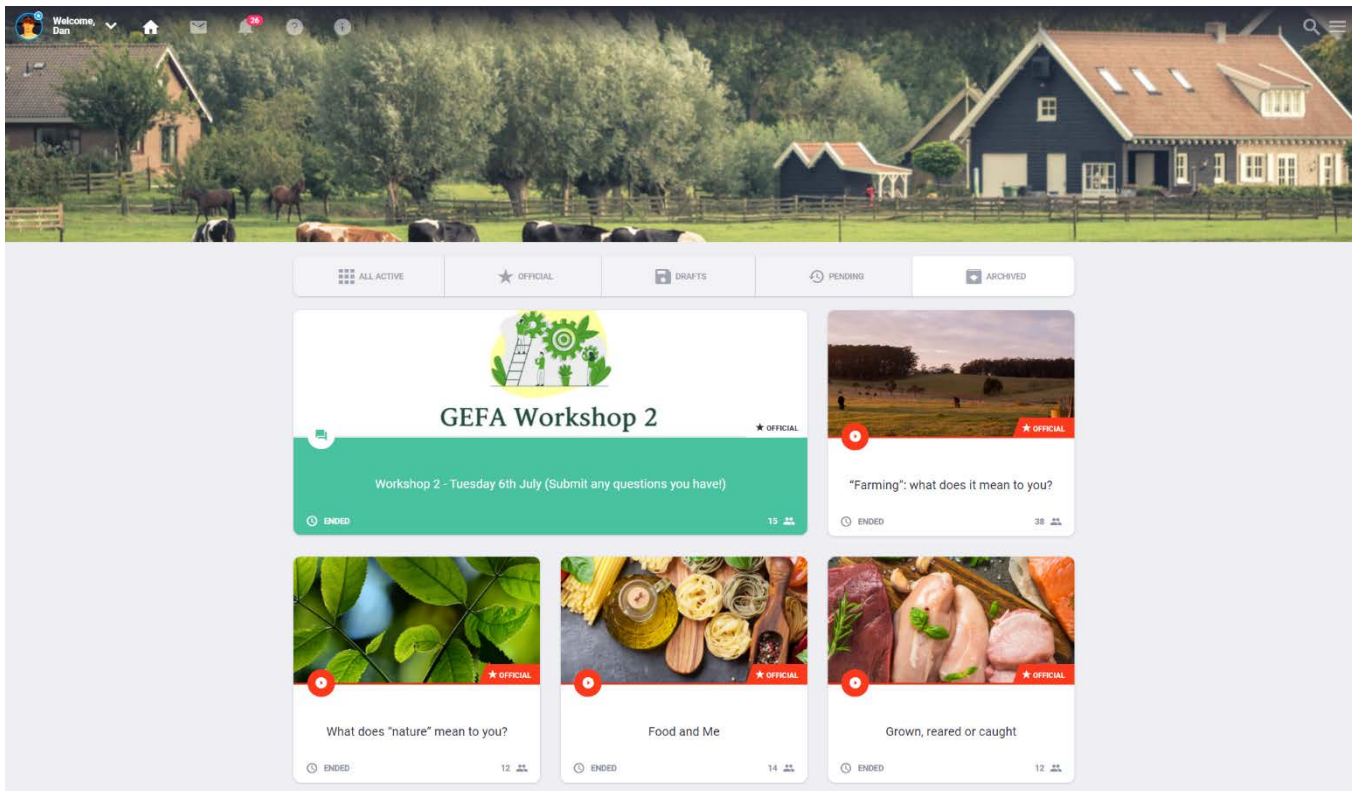
As illustrated by Figure 3 below, this public dialogue involved three workshops and three independent tasks each designed to inform the research as the process continued, inform stimulus creation and topic guides, and to create an engaging experience for the participants. For more detailed information on our research tools, please see [Section 5.4](#).

**Figure 3: Overview of methodology**



This was supported via a dedicated online engagement platform called Incling (see Figure 4). Incling allows for both live discussions and asynchronous activities including chat boards, polling and independent tasks such as uploading video, photo and audio.

**Figure 4: Image of the dialogue tasks hosted on the Incling platform**



Overall, the dialogue was designed to be exploratory and iterative. The focus of discussion, the experts' contributions, and the tasks undertaken were all developed in response to participants' interests concerns, and priorities, rather than being pre-set by the research team. The benefit of this approach is that it enabled participants to frame the subject of genome editing in farmed animals, and control the dialogue agenda, albeit within certain guardrails.

As part of the dialogue process, we undertook a rapid evidence assessment to (i) understand what public engagement had already been undertaken around genome editing and related technologies, (ii) identify material and content that could potentially be used as part of the dialogue process, and (iii) identify stakeholders who could contribute to the dialogue process as 'experts' in response to public requests.

In advance of Wave One, we filmed interviews with 11 stakeholders representing a range of views towards farming and genome editing, which was used to develop a balanced introduction presentation on genome editing in farmed animals (see Table 2).

**Table 2: Expert contributors to Wave One**

<b>Name</b>	<b>Field of expertise</b>	<b>Expert Organisation &amp; Role</b>
<b>Jonathan Birch</b>	Animal sentience/behaviour	Associate Professor of Philosophy and Principal Investigator (PI) on the Foundations of Animal Sentience project at London School of Economics
<b>Helen Browning</b>	Food sustainability	Chief Executive at Soil Association
<b>Alasdair Cochrane</b>	Animal ethics	Senior Lecturer in Political Theory at The University of Sheffield
<b>Helen Ferrier</b>	Farming	Chief Science and Regulatory Affairs Advisor at the National Farming Union
<b>Jeff Grainger</b>	Public funding of genome editing technologies	Associate Director - Thematic Research Challenges, at UKRI-BBSRC
<b>Patrick Holden</b>	Farming	Founding Director of the Sustainable Food Trust
<b>Phil Macnaghten</b>	Governance of science and technology	Professor of Technology and International Development at Wageningen UR
<b>Robin May</b>	Regulation	Chief Scientific Advisor at Food Standards Agency
<b>Peter Stevenson</b>	Animal welfare	Chief Policy Advisor at Compassion in World Farming
<b>Patricia Thomas</b>	Food sustainability	Director at Beyond GM / A Bigger Conversation
<b>Alan Tinch</b>	Commercial applications of genome editing technologies	Technical Services Director at Benchmark Breeding Genetics

We also tasked participants to produce short video responses to three exploratory questions relating to food, farming, and farmed animals, as well as their wider relationship to nature. This was designed as a warm-up exercise, helping to ensure that participants could see early on that many different views existed and were invited into the dialogue, and to give the research team an insight into future potential topics.

**Wave One** involved eight breakout group discussions, each involving 5-6 people and lasting 1.5 hours on a weekday evening (6.30-8.00 pm). The aim of Wave One was to explore participants' starting points around the issues, including surfacing behaviours and frames (conceptual, linguistic, visual), plus the associations and emotions which shaped participants' engagement with agriculture/farming and farmed animals. Within each breakout group, participants were presented with three videos covering the following:

- Participants' responses to a pre-workshop task undertaken in advance of Wave One, exploring people's relationship to food, farming, and farmed animals
- The views of expert stakeholders to help contextualise the application of genome editing in farmed animals by providing perspectives on the current system of farming animals and potential farming futures
- An introduction to genome editing technology, potential applications in farmed animals, and views

and considerations towards these applications from the expert stakeholders interviewed

While the focus of Wave One was deliberately broad, we also introduced the topic of genome editing in farmed animals to gain early spontaneous views and questions.

Following Wave One, participants completed a post-workshop task. Drawing on the literature review and the discussion which took place at the first workshop, we produced an ‘issues card’ sorting exercise which was undertaken through the [Q-Software](#) platform.<sup>20</sup> This exercise was an iteration of the Democs game in which participants reviewed a list of 32 issues relating to genome editing and sorted them according to those that most and least aligned with their views.<sup>21</sup> Further to this exercise – and an explicit question to participants on who they would like to hear from – we identified several expert stakeholders to support us in Wave Two. We also provided a discussion board that could be used by participants to chat about themes of interest during the study, and to respond to questions set by the research team.

**Wave Two** comprised panel discussions lasting 1.5 hours on a weekday evening (6.30-8.00 pm) in which participants were split evenly into two sub-groups. Each sub-group participated in two 40-minute discussions with panels of expert stakeholders. One panel comprised stakeholders who were involved in the direct application of genome editing in farmed animals or involved in regulatory discussions. The other panel comprised stakeholders involved in research which related to the ethics of genome editing in farmed animals. Details of panellists are provided in Table 3 below.

**Table 3: Expert contributors to Wave Two**

<b>Panel One (Applied expertise)</b>	<b>Panel Two (Ethics expertise)</b>
Neil Eastham (Bishopton Veterinary Group)	Jonathan Birch (London School of Economics)
Robin May (Food Standards Agency)	Katrien Devolder (University of Oxford)
Alan Tinch (Benchmark Genetics)	Tara Garnett (University of Oxford)
Bruce Whitelaw (Roslin Institute)	Adam Shriver (University of British Columbia)
	Peter Stevenson (Compassion in World Farming)

Participants could submit questions in advance of the session, as well as during the session itself. We identified four questions<sup>22</sup> which were asked in both groups and further questions were raised in the chat function and then selected by the panel Chair for participants to raise directly with the expert panellists.

The aim of Wave Two was to provide a space for participants to ask outstanding questions they had around genome editing in farmed animals, to state their views (including raising concerns), and to have the opportunity to debate with panellists.

Following Wave Two, we asked three questions of participants via the online engagement platform to understand the most salient points from the debate, their feelings toward genome editing in farmed animals, and issues that they wanted to discuss further in Wave Three. Responses to these questions

<sup>20</sup> We used Q-Software to perform a dedicated Q-Sort exercise. This is further detailed in the [Annex](#)

<sup>21</sup> See <https://www.stem.org.uk/resources/collection/3119/democs>

<sup>22</sup> "What benefits do the panel think gene editing will have on our food?"; "How should the welfare of farmed animals be taken into account in gene editing?"; "How are boundaries set for gene editing in farmed animals and how can people be sure that these will be followed?"; and "What do the panel believe might be some of the unintended consequences of gene editing in farmed animals?"

directly fed into the structure of the discussions planned for Wave Three.

**Wave Three** was the last phase of the public dialogue and again involved eight breakout group discussions, each involving 5-6 people and lasting 1.5 hours on a weekday evening (6.30-8.00 pm). Groups were composed of the same individuals as in Wave One, to facilitate group bonding and familiarity, and encourage open discussion. The aim of this final wave was to delve into the value judgements and ethical considerations around genome editing in farmed animals. To achieve this aim, we provided participants with four scenarios in which genome editing could be applied to farmed animals, including potential benefits or risks, to understand what people consider to be acceptable. We made clear that each of these scenarios had been developed simply to help participants clarify their own views; none of these scenarios were 'predictions' of what would happen.

These scenarios were:

- *Scenario A:* It's the year 2025. GEFA has helped improve the resistance of farmed animals to diseases (such as foot-and-mouth disease, or diseases that also pass over to humans like *E.coli*). However, in some cases it has also contributed to lower welfare standards for farmed animals as it enabled greater intensification of farming.
- *Scenario B:* It's the year 2025. GEFA has been used to benefit consumers by being used to improve the quality of meat or animal products (e.g., improving nutritional value) or the quantity of meat produced for consumers. However, in some cases, this has had negative impact on the health and welfare of farmed animals (e.g., chickens that are less able to move freely due to their size).
- *Scenario C:* It's the year 2025. GEFA has been used to reduce the distress experienced by farmed animals (e.g., when going to slaughter) by making them tamer and more docile. Advocates of GEFA say that this is better for animal welfare whereas critics say that this is changing what it is to be an animal.
- *Scenario D:* It's the year 2025. GEFA has enabled countries to increase (or, faced with increasing populations, to maintain) access to fish, meat, and animal products helping to reduce inequalities in access to food. Critics argue that this may contribute toward the maintenance of a system of food production that some say is unsustainable in the longer term.

The discussions held in Wave Three aimed to understand under what conditions, if any, participants would consider genome editing in farmed animals acceptable or even desirable, and whether genome editing in farmed animals could take place in an ethical and socially responsible manner.

All group discussions were recorded and transcribed. Moderators reviewed recordings and transcriptions, summarising findings within standardised pro-formas, with supporting quotes. These in turn were entered into a matrix map to allow for framework analysis and the comparison of views between each of the eight breakout groups. After each Wave, the core research team also held analysis sessions to review the evidence gathered, to make connections between different aspects of the topics discussed, and to make recommendations for the remaining dialogue process.

## 5.4. Research tools

The guide for our interviews with expert stakeholders is shown in Table 4.

**Table 4: Stakeholder Interview Topic Guide**

- *Introduce and explain aims of the study*
  - *Explain speaking with 10 expert stakeholders. Note use of the interview is to help contextualise research and inform stimulus for our workshops.*
  - *As part of this, we would ideally like to use aspects of discussion in presenting different issues and considerations to members of the public. Explain different options we have for this, consent, right to review and retract consent. Permission to record the session and for use of video.*
  - Can you tell me your name, role/organisation, and a little bit about your background?
  - As mentioned, the purpose of this interview is to help inform debate and stimulus for a public dialogue around the ethical issues associated with the potential use of gene editing in farmed animals. This dialogue will involve a series of three workshops with lay members of the public, from across the UK. We are assuming no prior knowledge on the part of those participating.
1. Thinking particularly about the first exploratory workshop with members of the public, before we get into the details of the potential use of GEFA, what are the big picture issues that could be helpful for people to think about to contextualise the debate? [Open then probe]
    - a. Relationships to food and farming
    - b. Food security – production/supply vs distribution/access/control
    - c. Role of technical innovation vs other solutions (e.g., economic reform)
  2. Thinking specifically about genome editing, how do you feel about its potential application to farmed animals? [Open then probe]
    - a. If you had to summarise it in one sentence, what do you believe is the purpose of GEFA?
    - b. What are the potential application areas?
    - c. What potential benefits may this bring? To whom (inc. animals and humans)? Are there other ways of achieving these outcomes? What is unique about gene editing in this context? Are there any problems that only genome technologies can address?
    - d. What difference do you think genome editing in farmed animals (GEFA) would make for UK farmers/ down on the farm? Is there any difference between the implications for ‘family’ farms and industrial farms? (i.e. who stands to benefit most)
    - e. What are some of the uncertainties in applying gene editing to farmed animals? How might these be best dealt with?
    - f. How do you think these benefits and uncertainties can best be conveyed or explored with members of the public?
      - i. Probe scientific and technical dimensions of gene editing
    - g. What are the key ethical issues for GEFA? To what extent do these differ versus other application areas?

- h. If not covered, considerations in respect of animal rights, including any differences in views between GE in livestock and fish?
3. Finally, I want to touch on the regulation of this area in the UK.
    - a. What purposes do you think regulation should serve beyond ensuring agricultural products are safe to eat?
    - b. What do you feel the goal for the regulation of GEFA should be?
    - c. What are your thoughts about the current approach to regulation in the UK?
    - d. Do you see a distinction between gene editing and GMOs? Why? To what extent should this be reflected in regulation?
    - e. What are the ethical issues associated with such a regulatory approach?
  4. Are there any other points you'd like to raise?

### Workshop One Pre-task

Prior to Workshop One, participants were asked to submit three video responses following three of the four prompts below<sup>23</sup> These videos were also used as part of the stimulus in Workshop One:

1. **“Farming”**: what does it mean to you? Make a short video (45-60 seconds) to explain what “farming” means to you. This might include your experiences and understanding of farming, or what kind of images come to your mind when thinking about farming and agriculture in the UK.
2. **What does “nature” mean to you?** Make a short video (45-60 seconds), near your home, of what “nature” means to you. This could relate to plants, animals, your local environment or the planet more broadly. In your video, it would be good to hear whether and how you feel connected to nature, and what helps or hinders a feeling of connection.
3. **Food and Me.** Tell us about your relationship with food. Make a short video (45-60 seconds) to explain the role food plays in your life. We’re interested in hearing about what influences what you choose eat and when. Take inspiration from a recent food shop or by thinking about the meals you tend to cook.
4. **Grown, reared or caught** (*non-vegan/vegetarians only*): Please go to your fridge and choose one meat, fish or animal product (this could be anything from a piece of steak or pack of bacon, to a pair of kippers, to a pack of butter or eggs). In your own words, say how you think that produce came to be in your fridge? Where do you think it came from? How do you think it was produced? How much do you need or want to know about its origin? Please record a short video (45-60 seconds) with your thoughts, including your reflections on what you know, don’t know or don’t think about. Feel free to use props.

<sup>23</sup> Participants were randomly allocated three out of four tasks to reduce the level of onus placed on individuals at this early stage in the process.



## Workshop One

Workshop One took place on 15<sup>th</sup> June.

The stimulus for this workshop was developed using footage from the stakeholder videos as well as participants' submissions for the Workshop One Pre-task. The stimulus for this session included:

1. A 10-minute film created from content produced by participants that illustrated their relationship to food and farming.
2. A 8-minute film about farming and food futures, using visuals and clips from the expert interviews.
3. A 7-minute video introducing the technology behind and some of the uses of genome editing in farmed animals.

The topic guide for workshop One is shown in Table 5.

**Table 5: Workshop One Topic Guide**

Timings	Content
6.30 – 6.40pm	<p><b>Welcome</b></p> <p><i>Purpose: to introduce format and purpose for the public dialogue; to ensure participants get to know one another and feel comfortable engaging in the dialogue</i></p> <p><i>Moderator to introduce themselves and the dialogue:</i></p> <p>'Hi everyone. I'm [NAME] and will be helping to manage discussions we'll be having as part of this public dialogue on gene editing in farmed animals. As you may have seen from the introductory video on Incling, we've been asked to carry out this dialogue, which involves over 40 members of the public from across the UK, by the Nuffield Council on Bioethics.</p> <p>The Nuffield Council on Bioethics are an independent body that informs policy and public debate about the ethical questions raised by biological and medical research.</p> <p>They are interested in hearing your views on the potential application of gene editing to farmed animals, which in turn will help contribute to the evidence base considered by both government and the science community.</p> <p>We don't expect you to have any knowledge about gene editing or farming. What we do expect is for you to take part in the discussions we will have by giving your perspective and by listening and responding to the perspectives of other people. The key ground rule in this process is to be respectful of other people's views. We have brought together a very diverse group of people and it is likely that people will have different views. We want to hear and understand this diversity of views.</p> <p>y job today is to help us to have a good conversation and this will cover off various different topics. As we move through the conversation you might feel you haven't had the opportunity to say as much as you have wanted. I would encourage you to use the chat function if you want to, and also the Incling community has an open forum for you to raise additional thoughts.</p> <p>We will be recording the session today. Just to confirm that everyone is still happy with this? <i>[Moderator to gain verbal consent. All participants have previously provided written consent.]</i></p> <p><i>[If necessary. We also have a member of the Nuffield Council on Bioethics joining us</i></p>

	<p>today to observe the session. XXX do you want to briefly say Hi?']</p> <p>Now, if we can briefly go around the virtual table and introduce ourselves that would be great. Perhaps if you can say your name and tell everyone, if you could be any animal, what animal would you be and why. If you have a preferred pronoun please also let us know. I'll start... XXX do you want to go next?</p>
<p>6.40 – 6.50pm</p> <p>6.50- 7.05pm</p>	<p><b>Food and you</b></p> <p><i>Purpose: to provide participants with a sense of how other members of the public relate to nature, food and farming, leading into discussion around the relationship between people and animals, and what makes an animal an animal.</i></p> <p>Before we carry on the conversation, we thought it would be good for you to get a short introduction to some of the other participants taking part in the dialogue, so I'm going to play you some short clips taken from your pre-task videos.</p> <p><i>Moderator to show Stimulus Set #1.</i></p> <ul style="list-style-type: none"> <li>• I'd like to get your reflections on what they heard from the pre-task videos, specifically what resonated with you? What was different to your own views and experiences? <i>Probe and draw out:</i> <ul style="list-style-type: none"> <li>▪ People's relationship to food</li> <li>▪ People's relationship to farming</li> <li>▪ Views on farmed animals</li> </ul> </li> <li>• Now we just want to play a quick word association exercise. Please say what comes to mind when I say: <ul style="list-style-type: none"> <li>○ Dog</li> <li>○ Pig</li> <li>○ Bear</li> <li>○ Cow</li> <li>○ Salmon</li> <li>○ Rabbit</li> <li>○ Chicken</li> </ul> </li> </ul> <p><i>Moderator to the spend some time with participants teasing out the differences (or similarities) between those concepts that arise relating to farmed animals as a category versus domesticated or wild animals.</i></p>
<p>7.05 – 7.15pm</p>	<p><b>Food and farming choices [now and in future]</b></p> <p><i>Purpose: to explore factors influencing choices of meat/fish consumption, introduce and get responses to stimulus on farming and selective breeding, and to explore the interaction between the role of animals in different types of potential farming futures</i></p> <ul style="list-style-type: none"> <li>• So, we saw in the videos that you produced that meat features as a part of many people's diets. How do people feel about eating meat or fish? <i>Probe:</i> <ul style="list-style-type: none"> <li>○ Experience of eating meat or fish</li> </ul> </li> </ul>

<p>7.15-7.23pm</p> <p>7.23-7.35pm</p>	<ul style="list-style-type: none"> <li>○ Any difference in feelings or experience toward consuming meat or fish</li> <li>○ Cultural significance of eating meat/fish</li> <li>○ Changes to patterns of meat consumption, including choices not to consume meat or to reduce consumption (both recent and historical)</li> <li>○ Are there any situations, shops or types of food, where you think more actively about where that food has come from (i.e. where and how it was produced)? Why in those circumstances?</li> <li>○ Price of food/meat; cost as an influencing factor on choice</li> <li>○ Does anyone prioritise criteria like wild, organic or free-range in any of the food they purchase? If so when, what types of produce and why?</li> <li>● Animal produce like milk and eggs also feature as a part of many people's diets. Again, how do people feel about eating these? <i>Probe:</i> <ul style="list-style-type: none"> <li>○ Similarities or differences in views toward these products compared to meat</li> <li>○ Whether and when people think about animal produce like milk, in terms of the animal from which it was produced and how this influences their choices to what to purchase</li> </ul> </li> </ul> <p><i>Moderator to show Stimulus Set #2.</i></p> <ul style="list-style-type: none"> <li>● What are your thoughts on what you just heard? Did anything in particular stand out to you? Anything surprising or concerning?</li> <li>● As you just heard. There are many different visions for what the future of livestock and fish farming could look like. Some are more intensive with high outputs at relatively low cost, some involve more precision farming supported by new technologies, some revolve around more organic principles or sustainable methods, others involve less livestock at all. Each involve trade-offs in respect of the cost of meat, the quantity and quality of meat, animal welfare, and the environment. <ul style="list-style-type: none"> <li>○ Based on what you have heard, and what you know already about farming, what does each of these models say about the role of farmed animals? <i>Moderator to probe on each in turn: industrial farming, precision farming, agro-ecological farming, and no livestock farming</i></li> <li>○ What do you think each of these models say about us, as a society? <i>Moderator to again probe on the four models.</i> How do people feel about that?</li> </ul> </li> </ul>
<p>7.35-7.40pm</p>	<p><b>Introducing GEFA</b></p> <p><i>Purpose: to capture awareness and top-of-mind understanding of gene editing, to introduce the topic and get initial responses to more and less acceptable uses of GEFA, and key emerging questions for participants.</i></p> <ul style="list-style-type: none"> <li>● Can I just do a quick poll, how many of you have heard of gene editing before being invited to participate in this research?</li> <li>● Regardless of whether you have heard about gene editing before or not, I'd like</li> </ul>

<p>7.40-7.47pm</p> <p>7.47 – 8.00pm</p>	<p>everyone to use the chat function to write a quick description of what they think gene editing involves. Don't worry about it being technically right – we're just interested in what you think it involves.</p> <ul style="list-style-type: none"> <li>• <i>Moderator to pick someone who said they had heard about gene editing before.</i> [NAME] do you recall where you heard about gene editing? Probe on sources of information.</li> </ul> <p><i>Moderator to show Stimulus Set #3.</i></p> <ul style="list-style-type: none"> <li>• This dialogue is about the potential application of gene editing to farmed animals. We are interested in hearing your views about if and how this technology is used in farmed animals, but this discussion needs to be situated in the relationship you want us to have with animals. When we meet again in a few weeks there will be an opportunity for you to talk with people who have a range of views and experiences. These could include vets and farmers through to scientists and regulators. To help inform who we invite to talk with you it would be good to understand: <ul style="list-style-type: none"> <li>○ What are your initial thoughts about what you just heard in that brief introduction to gene editing?</li> <li>○ What are the key benefits that jumped out? Were there any applications of gene editing that you felt were more desirable than others? Why?</li> <li>○ Do you have any key concerns or questions about the technology or how it is applied to farmed animals?</li> <li>○ Based on what you've heard, what types of people would you want to speak with at the next session to help you understand more about these applications, potential benefits and risks?</li> <li>○ <i>[If time]</i> link back to the future and values expressed earlier</li> </ul> </li> </ul>
	<p><b>Close</b></p> <p>Thank you all for your time this evening. It was wonderful to meet you all. The next workshop will be on 6<sup>th</sup> July, before then we will be setting you a short task in the next day or two and would be grateful if you could participate in this as quickly as possible as it will help us shape the next workshop. Thanks again and have a great evening.</p>

### Workshop One post-task

Immediately following Workshop One, participants were asked to complete a post-task which was used to inform stakeholder selection for Workshop Two and development of stimulus for Workshop Two. Drawing on the rapid evidence assessment and the discussion taking place during Workshop One, we produced an “issues card” sorting exercise. This exercise was an iteration of the Democs Game in which participants reviewed a comprehensive and balanced list of 32 issues and benefits relating to genome editing, and sorting those according to those they are most and least likely to agree with.

The task was posted on Incling but the card sorting exercise was completed using Qsoftware software. Participants were given a short video via Incling demonstrating how to use the Qsoftware software and were provided with a unique link to complete the task.

Participants dragged and dropped cards into the appropriate boxes following the prompt:

“Please drag the statements into the boxes as they relate to the below prompt:

***This statement aligns with my current feelings about gene editing in farmed animals. ‘Gene editing of farmed animals...’***

The Qsort limited the number of cards they could put in each of the boxes. The box options and their card limits were:

<b>Box Name:</b>	Does Not Align (-5)	(-4)	(-3)	(-2)	(-1)	Neutral (0)	(1)	(2)	(3)	(4)	Does align (5)
<b>Card limit</b>	1	2	3	3	4	6	4	3	3	2	1

**Table 6: Workshop Two post task card sorting list**

1	Is ethical
2	Is natural
3	Is safe
4	Is artificial
5	Is worrying
6	Is acceptable
7	Will result in more intensive farming systems
8	Is a step too far
9	Is similar to selective breeding techniques
10	Is similar to genetic modification
11	Will have unforeseen consequences for animals
12	Will have unforeseen consequences for humans
13	Will reduce deaths and diseases in farmed animals
14	Will help tackle climate change
15	Will reduce social inequalities in access to meat/fish
16	Is more acceptable in some farmed animals than others
17	Will lead to less stressed farmed animals
18	Will lead to healthier farmed animals
19	Will lead to greater mistreatment of farmed animals
20	Will provide a sustainable source of protein
21	Will result in lower welfare standards for animals
22	Is a violation of animal rights

23	Will be carefully regulated
24	Will result in allergen-free animal products
25	Will be beneficial for farmers
26	Will lower the cost of meat and fish
27	Will improve farmed animal welfare
28	Will improve the quality of meat and fish
29	Will increase the quantity of meat and fish produced
30	Is good for consumers
31	Is undignified for the animal
32	Will be benefit big businesses, rather than small farmers

### Workshop Two

Workshop Two took place on 6<sup>th</sup> July. This session involved two panel of a total of nine expert stakeholders. Participants were broken into two equal sized groups and spent half the time with each of the panels in a moderated session. Participants were able to submit questions ahead of the session via Incling as well as live via the chat or directly by raising their hand.

### Workshop Two post-task

Following Workshop Two participants were asked to respond to three questions reflecting on Workshop Two (see Table 7). Participants submitted these questions directly via the Incling Platform.

**Table 7: Workshop Two Reflection Questions**

1.	What is the most important thing you learned from the panel discussions on Tuesday evening, either from 'experts' or through the points raised by other participants?
2.	How did you come away feeling about gene editing in farmed animals after the workshop? Was there anything that you heard which made you really question what you had believed or felt about gene editing in farmed animals, or anything that reinforced your existing views
3.	If you could pick one issue relating to gene editing in farmed animals that you would love to talk through in more detail at our final workshop next week, what would it be?

### Workshop Three

This session was held on 15<sup>th</sup> July.

The topic guide for Workshop Three is shown in Table 8.

**Table 8: Workshop Three topic guide**

Timings	Content
6.30 – 6.40pm	<p><b>Welcome</b></p> <p><i>Purpose: to set out session plan for the evening’s discussions and recap on ground rules</i></p> <p><i>XXX to introduce:</i></p> <p>‘Hi everyone. Welcome back. For those of you who I haven’t met, I’m Darren and am helping to run this public dialogue on gene editing in farmed animals.</p> <p>Tonight is our last workshop and we will be breaking you out into small groups again shortly, where you will have the chance to speak again with those 4-5 other participants who you met in the first workshop back in mid-June.</p> <p>To recap, this public dialogue is being undertaken on behalf of the Nuffield Council on Bioethics which is an independent body that informs policy and public debate about the ethical questions raised by biological and medical research. They are interested in hearing your views on the potential application of gene editing to farmed animals, which in turn will help contribute to the evidence base considered by both government and the science community.</p> <p>Over the past two workshops we have introduced you to gene editing and you have heard different perspectives on gene editing of farmed animals. Tonight we want to understand what you think and feel, and most importantly, why.</p> <p>Before we split you into your smaller groups I’d just like us to ask some short questions of the whole group as a bit of a warm-up. It can be difficult for people in sessions like these to see quite how their views align with those of others so I’m going to ask a few questions and I want you to answer by responding to the poll which should pop up in front of you when I launch the question.</p> <p>So our first one is a bit of a warm up just to ensure people can see how it works: if I were to ask you all whether you were happy with the football result on Tuesday what would you say? [All polling to have Yes, No, Unsure as response options]</p> <p>OK, so you’ve got the hang of it, now:</p> <ul style="list-style-type: none"> <li>● How comfortable are you with the idea of gene editing in farmed animals?</li> <li>● Are there SOME circumstances where you think gene editing in farmed animals could be acceptable, or even desirable?</li> <li>● Are you concerned that gene editing of farmed animals might pose risks to human health?</li> <li>● Do you feel that gene editing of farmed animals could be beneficial for animal health and welfare?</li> <li>● Can you see gene editing of farmed animals helping lead to environmental benefits?</li> </ul> <p>Excellent thank you all.</p> <p>As with the previous workshops, we want you to take part in the discussions we will</p>

	<p>have by giving your perspective and by listening and responding to the perspectives of other people.</p> <p>The key ground rule in this process is to be respectful of other people's views. We have brought together a very diverse group of people and it is likely that people will have different views. We want to hear and understand this diversity of views.</p> <p>The second key ground rule is to contribute! We really need to hear from all of you today. Don't worry if others agree or disagree, don't worry if you're thinking aloud and forming your opinion as you go - that's ok, we really want to hear where you're at.</p> <p>We'll now break up into our small group discussions and I look forward to seeing you all again at the end of the evening.'</p>
6.40 – 6.55pm	<p><b>Reflections on GEFA</b></p> <p><i>Purpose: to provide a space for participants to reflect on the Question Time debate, including if and how their views toward GEFA have altered over the course of the dialogue.</i></p> <p><i>Moderator to introduce:</i></p> <p>Hi everyone. I'm [NAME]. Nice to see you all again. As with the first workshop, my role today is to help us to have a good conversation and this will cover off various different topics.</p> <p>As before please feel free to use the chat function if there are things that you would like to say that you haven't had the opportunity to.</p> <p>We will be recording the session today. Just to confirm that everyone is still happy with this? <i>[Moderator to gain verbal consent. All participants have previously provided written consent.]</i></p> <p>Now, as it's been a few weeks since we last met as a group, if we can briefly go around the virtual table and re-introduce ourselves that would be great. If you can say your name and perhaps say one word which describes how you felt about GEFA following the panel debate that we had last Tuesday evening. XXX do you want to go first?'</p> <ul style="list-style-type: none"> <li>● <i>Moderator to explore responses and understand the degree to which words/views are shared or differ between participants</i></li> <li>● During our previous sessions you will have heard people talking about the range of different potential applications of GEFA. These included: increasing the disease resistance of farmed animals; improving the quality and quantity of meat or milk produced; improving animal welfare; and directly supporting improvements in human health.</li> </ul> <p>When thinking of gene editing in farmed animals, do any of these applications feel more desirable than others? <i>Spend time exploring participant views/rationale.</i></p>
6.55 –	<p><b>Value judgements</b></p> <p><i>Purpose: to explore the value judgements underpinning participant views and the basis for these (which may be intuition, morals, cultural values, pragmatism etc.).</i></p> <p><i>Moderator to explain:</i></p>



7.20pm	<p>'We have seen throughout this dialogue process that people have very different views toward GEFA, but that the reasons for these vary and, while some reasons are easy to speak about, others are more difficult and may just be a positive or negative feeling.</p> <p>We want to spend the rest of the session trying to understand why people feel the way they do, and if/how this might change depending on how you look at GEFA.</p> <p>One way for us to do this is to look at different scenarios in which gene editing could be applied to farm animals, including potential benefits or risks, to understand what people consider to be acceptable.</p> <p>What I would like to do is for you to consider two scenarios, and for us to discuss whether, in that scenario, you feel that it would be acceptable or even desirable to employ gene editing in farmed animals, and why. We will imagine it's a few years from now and genome editing is being used in farmed animals, with different impacts. We're not saying any of these are 'true' futures - we just want to imagine what it might feel like to live in that world, as a way of talking through what we want or do not want in relation to this technology.</p> <p>We have around 20 minutes for this, so around 10 minutes per scenario. We do want everyone to contribute here, so please be respectful and treat this as a safe space. There will be ethical dimensions to these discussions so please just talk about your feelings in response to these scenarios – you don't need to necessarily be able to explain exactly why you feel the way you do.</p> <p>[MODERATORS TO EACH HAVE TWO OF THE FOLLOWING FOUR SCENARIOS; ROTATED SO EACH SCENARIO IS DISCUSSED IN FOUR GROUPS]</p> <p><b>Scenario A:</b> It's the year 2025. GEFA has helped improve the resistance of farmed animals to diseases (such as foot-and-mouth disease, or diseases that also pass over to humans like E.coli). However, in some cases it has also contributed to lower welfare standards for farmed animals as it enabled greater intensification of farming.</p> <p><b>Scenario B:</b> It's the year 2025. GEFA has been used to benefit consumers by being used to improve the quality of meat or animal products (e.g. improving nutritional value) or the quantity of meat produced for consumers. However, in some cases, this has had negative impact on the health and welfare of farmed animals (e.g. chickens that are less able to move freely due to their size).</p> <p><b>Scenario C:</b> It's the year 2025. GEFA has been used to reduce the distress experienced by farmed animals (e.g. when going to slaughter) by making them more tame and docile. Advocates of GEFA say that this is better for animal welfare whereas critics say that this is changing what it is to be an animal.</p> <p><b>Scenario D:</b> It's the year 2025. GEFA has enabled countries to increase (or faced with increasing populations, to maintain) access to fish, meat and animal products helping to reduce inequalities in access to food. Critics argue that this may contribute toward the maintenance of a system of food production that some say is unsustainable in the longer term.</p> <p><i>Moderator to show each of the scenarios on screen and facilitate a discussion.</i></p> <ul style="list-style-type: none"> <li>● Do you feel in this scenario that it would be acceptable or even desirable to employ gene editing in farmed animals? Why/why not? Explore here:       <ul style="list-style-type: none"> <li>○ Who or what might benefit in each of the scenarios explored? Is it important</li> </ul> </li> </ul>
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<p>7.20 - 7.25pm</p>	<p>that they benefit? Why?</p> <ul style="list-style-type: none"> <li>○ The language/metaphors/associations/etc. people use to articulate their views</li> <li>○ Areas of consensus or disconsensus, including tensions</li> <li>○ Conditions under which participants would support GEFA, including trade-offs people were most/least willing to make to achieve particular benefits and trustworthiness of technology</li> <li>○ Red lines of concern</li> </ul> <ul style="list-style-type: none"> <li>● If benefits from GEFA come about, does it matter that they come about through technology? (i.e., does the fact that GEFA uses technologies raise any concerns for the participants? Then probe why – e.g., questions of naturalness)</li> </ul> <p><i>Moderator to explain:</i></p> <p>There is the potential for GEFA to be used to achieve health and welfare outcomes <u>for animals</u> (like polling to reduce cattle using horns to injure others and Avian influenza which is highly contagious and has high mortality) <u>and for humans</u> (e.g. removing food allergies) that could not be easily achieved by more conventional farming methods.</p> <p>Equally GEFA could be used to achieve outcomes for animals or humans which could have been delivered by other more conventional farming methods (e.g. reducing diseases through more agro-ecological forms of farming) though this could take more time and come at a cost to consumers.</p> <ul style="list-style-type: none"> <li>● How do people feel about GEFA being used to achieve outcomes which could not be achieved by other means? <i>Explore and then probe for those who <u>do consider this to be acceptable</u>:</i> <ul style="list-style-type: none"> <li>○ <i>For those who do consider this to be acceptable:</i> Is there any difference in using GEFA to achieve outcomes that could be achieved in other ways?</li> <li>○ <i>For those who do not consider this to be acceptable:</i> Are there particular reasons why you are not comfortable with this?</li> </ul> </li> </ul> <p><i>Moderator to explain:</i></p>
<p>7.25 - 7.30pm</p>	<p>There is also the potential for GEFA to be used to create farmed animals with characteristics that could have come about through selective breeding or evolution, or it could be used to create farmed animals that have characteristics which would never have evolved in their current species.</p> <ul style="list-style-type: none"> <li>● Is there any difference in using GEFA to create farmed animals that could or could not have otherwise existed?</li> <li>● To what extent is gene editing technology seen as an extension of selective breeding techniques? How is it similar or different?</li> <li>● Are people comfortable with using GEFA to create farmed animals that have characteristics that could potentially have arisen with selective breeding? What about to create farmed animals that have characteristics that could not arise with selective breeding or evolution? Why/why not?</li> </ul>

7.30 – 7.55pm	<p><b>Looking forward</b></p> <p><i>Purpose: to explore the value judgements underpinning participant views and the basis for these (which may be intuition, morals, cultural values, pragmatism etc.).</i></p> <ul style="list-style-type: none"> <li>● As a group, I'd like to hear what you believe our societal goals should be for our food system? <i>Probe on for example: safety, equity, access, quality, sustainability, animal welfare etc.</i></li> <li>● If you assume that gene edited produce is safe for human consumption and is as good from a quality/taste perspective, do you believe that gene editing could help to achieve those goals? Explore what, if any, role gene editing could play and why.</li> <li>● To what extent do you think that GEFA could take place in an ethical and societally responsible manner? Probe: <ul style="list-style-type: none"> <li>○ Under what conditions or what standards or principles would need to govern decisions taken around GEFA for people to be more/most comfortable with it</li> </ul> </li> <li>● Is GEFA ethically 'right' or does it cross a moral or scientific line that people are uncomfortable with, and if so, where/what is that line for different people? Allow spontaneous responses then probe: <ul style="list-style-type: none"> <li>○ For example, Peter Stevenson talked about looking at any new technology to understanding if it is more detrimental to welfare, if there is a less invasive solution and if it could entrench factory farming. Where would you draw your red lines in relation to GEFA?</li> <li>○ What influences where you would draw your red lines? (For example does it relate to your knowledge of farming, how 'close' you feel to farm animals, your religious or cultural values, concerns around technology, capitalism or the planet etc.)</li> </ul> </li> <li>● If you could speak directly to Government about the potential use of GEFA in the UK, what would you want to say?</li> </ul> <p><i>Moderator to explain that we will now all go back to the main plenary room to finish up the session.</i></p>
7.55	<p><b>Close [in plenary]</b></p> <p>Thank you all for your time again this evening and over the course of this dialogue. It's been a pleasure to meet you and have the opportunity to hear your thoughts on this important subject. Before we go I just wanted to invite the Nuffield Council on Bioethics, who commissioned this work, to say a few words.</p> <p><i>NCoB to thank and highlight next steps.</i></p> <p>Thanks again everyone and have a great evening.</p>

## 5.5. Reflecting on the dialogue process

The Nuffield Council on Bioethics carried out their own evaluation, including surveys of participants following each Wave of the public dialogue process, and of the experts involved in Wave Two, to capture feedback on the process. This feedback was summarised and provided to Basis, helping to refine the approach between Waves as well as generating learnings for future online dialogues around a similar subject matter.

Overall, the feedback from participants was very positive and participants enjoying the workshops and the process. Following Wave Three – the overall experience was typically rated between 8-9 out of 10 (where 10 equated to ‘enjoyed it a lot’), and level of comfort in contributing to discussions similarly between 8-9 out of 10 (where 10 equated to ‘very comfortable’).

The dialogue was not without its challenges. Typically, dialogue processes such as these are conducted face-to-face, but remote conduct was critical for safe and ethical participant involvement given the pandemic. Some of the concerns raised were technical. For example, bandwidth issues caused a small number of people to ‘drop out’ from the platform during Wave One.

Feedback related to the use of stimulus was positive overall, with participants reporting that they enjoyed the tasks as well as the stimulus shared during the workshops. The stimulus from Wave One as well as the recordings of the panel sessions from Wave Two were shared with participants following the sessions. Individuals who had technical trouble during the sessions, or were unable to attend due to personal conflicts, were requested to view these prior to attending the next workshop.

Prior to Wave One, information on what to expect over the course of the dialogue was shared, reiterating that participants did not need to come with any prior knowledge. In feedback a small number of participants still reported they were uncertain what would be expected of them and expressed concern about having enough knowledge or confidence in the subject to effectively contribute.

Following Wave Two, some participants and experts reported that the workshop felt split between ‘pro’ and ‘anti’ genome editing in farmed animals. On reflection, the split of experts into ‘applications’ and ‘ethics’ (despite a range of views within each panel) compounded this perception. In future dialogues, mixing panellists across a range of expertise is recommended.